

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP



(NASA-CR-178809) A DATA BASE AND ANALYSIS
PROGRAM FOR SHUTTLE MAIN ENGINE DYNAMIC
PRESSURE MEASUREMENTS. APPENDIX B: DATA
BASE PLOTS FOR SSME TESTS 901-290 THROUGH
901-414 Final Report (Wyle Labs., Inc.)

N86-23635

G3/20 Unclassified
06053



research REPORT

WYLE LABORATORIES - RESEARCH STAFF
TECHNICAL REPORT 66338-01

A DATA BASE AND ANALYSIS PROGRAM
FOR SHUTTLE MAIN ENGINE
DYNAMIC PRESSURE MEASUREMENTS
APPENDIX B

DATA BASE PLOTS FOR SSME TESTS
901-290 through 901-414

by

Thomas Coffin

A final report of
work performed under contract NAS8-34343

for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812

January 1986

FOREWORD

This report describes a dynamic pressure data base and data base management system developed to characterize the Space Shuttle Main Engine (SSME) dynamic pressure environment. The data base represents dynamic pressure measurements obtained during single engine hot firing tests of the SSME. Software is provided to permit statistical evaluation of selected measurements under specified operating conditions. An interpolation scheme is also included to estimate spectral trends with SSME power level. This report was prepared by Wyle Laboratories Scientific Services and Systems Group for the National Aeronautics and Space Administration, George C. Marshall Space Flight Center. The work was performed under NASA contract NAS 8-34343, entitled "Flow Dynamic Environments in High Performance Rocket Engines."

The author wishes to acknowledge the contribution to this study by Dr. G. Meares, Chief Architect of the data base management software described herein. Messrs. B. Dobbs and D. Duck contributed long hours over a digitizer pad to accomplish data base input. The singular value decomposition software for spectrum interpolation was developed by Dr. J. Jong. Mr. T. Nesman, MSFC technical contract monitor, provided continuing support through informal project reviews and served as a focal point for definition of SSME data requirements.

DATA PLOT LISTING FOR TEST STAND A1

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
290	MMC HOT GAS IN PR	40,000	25 55 75 195 315 435 500
293	HPOP DS PR	20,000	10 200 400 600 800
	PBP DS PR		10 200 400 600 800
	OPB PC PR DC		10 200 400 600 800
294	HPOP DS PR	20,000	10 40 100 300 500 645 660
	PBP DS PR		10 40 100 300 500 645 660
	OPB PL		10 40 100 300 500 645 660

DATA PLOT LISTING FOR TEST STAND A1 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
294	HPOP IN PR	20,000	10 40 100 300 500 645 660
295	HPOP DS PR		20 45 100 300 450 500
	PBP DS PR		20 45 100 300 450 500
	HPOP IN PR		20 45 100 300 450 500
	OPB PC PR DC		20 45 100 300 450 500
297	HPOP DS PR		6
	PBP DS PR		
	OPB PC PR DC		
	HPOP DS PR		
	PBP DS PR		
	HPOP IN PR		
	AUX LX I PR		
	OPB PC PR DC		
	PBP DS PR		
	HPOP IN PR		
300	OPB PC PR DC		

DATA PLOT LISTING FOR TEST STAND A1 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
301	HPOP DS PR	20,000	
	PBP DS PR		100
	OPB PC PR DC		250
	HPOP DS PR		400
303	PBP DS PR		100
	HPOP IN PR		250
	OPB PC PR DC		400
	HPOP DS PR		5
	PBP DS PR		30
	HPOP IN PR		45
304	OPB PC PR DC		5
	HPOP DS PR		30
	PBP DS PR		45
	LPFP DS PR		5
	FPB FUEL MAN PR		50
	HPOP IN PR		75
	HI LX I PR		5
305	HPOP DS PR		50
			75
			25
			50
			5

DATA PLOT LISTING FOR TEST STAND A1 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
305	PBP DS PR	20,000	5
	FPB FUEL MAN PR		25
	HPOP IN PR		50
	HI LX I PR		75
306	HPOP DS PR		5
	MCC HOT GAS IN PR	40,000	5
	PBP DS PR		6
	FPB FUEL MAN PR		35
	HPOP IN PR		70
	HI LX I PR		5
307	HPOP DS PR		20
			50
			75
			5
			20
			50
			75
			5
			20
			50
			75
			5
			20
			50
			75
			5
			20
			45
			70

DATA PLOT LISTING FOR TEST STAND A1 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
307	MCC HOT GAS IN PR	40,000	5
			20
			45
			70
	PBP DS PR	20,000	5
			20
			45
			70
	FPB FUEL MAN PR		5
			20
309	HPOP IN PR		45
			70
			5
	HI LX I PR		20
			45
			70
	HPOP DS PR		5
			20
			70
	MCC HOT GAS IN PR		6
310			30
	PBP DS PR		6
			30
	HPOP IN PR		6
			24
	HI LX I PR		6
			24
	HPOP DS PR		6
			30
	MCC HOT GAS IN PR		6
311			30
	PBP DS PR		6
			30
	HPOP IN PR	2,000	6
			30
	HI LX I PR		6
			30
	HPOP DS PR		6
			30
	MCC HOT GAS IN PR		6
	PBP DS PR		30

DATA PLOT LISTING FOR TEST STAND A1 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
311	HPOP IN PR	20,000	6
	HI LX I PR		30
	MCC HOT GAS IN PR		6
312	HPOP IN PR		30
	HI LX I PR		6
	MCC HOT GAS IN PR		40
313	HPOP IN PR		6
	HI LX I PR		40
	MCC HOT GAS IN PR		6
	HPOP IN PR		30
	HI LX I PR		4
	MCC HOT GAS IN PR		30
	HPOP IN PR		6
	HI LX I PR		4
314	HPOP DS PR		30
	MCC HOT GAS IN PR		6
	PBP DS PR	40,000	30
	HPOP IN PR	20,000	6
	HI LX I PR		30
	HPOP DS PR		6
315	HPOP DS PR		30
	MCC HOT GAS IN PR		40
	PBP DS PR		30
	HPOP DS PR		6
	MCC HOT GAS IN PR		30
	PBP DS PR		4
	HPOP DS PR		30
316	HPOP DS PR		4
	MCC HOT GAS IN PR		11
	PBP DS PR		4
	HPOP DS PR		11
	MCC HOT GAS IN PR		4
	PBP DS PR	40,000	11
	OPB PC PR DC	20,000	4
317	HPOP DS PR		11
			4
			11

DATA PLOT LISTING FOR TEST STAND A1 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
317	MCC HOT GAS IN PR	20,000	4
		40,000	11
	PBP DS PR	20,000	4
	OPB PC PR DC	20,000	4
319	HPOP DS PR	20,000	11
	MCC HOT GAS IN PR	20,000	6
		30	30
		92	92
	PBP DS PR	20,000	6
	MCC IN PR	40,000	12
		60	60
		180	180
	OPB PC PR DC	20,000	6
321	MCC HOT GAS IN PR	20,000	30
		90	90
		100	100
		270	270
	FPB PC	20,000	6
	OPB PC PR DC	20,000	30
		90	90
		100	100
		270	270
		6	6
		30	30
		90	90
		100	100
		270	270

DATA PLOT LISTING FOR TEST STAND A1 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
322	HPOP DS PR	20,000	6
			130
			170
			190
			210
			230
			260
			280
	MCC HOT GAS IN PR		6
			130
			150
			170
			190
			210
			230
			260
			280
	PBP DS PR		6
			130
			150
			170
			190
			210
			230
			264
			284
	FPB PC		6
			130
			150
			170
			190
			210
			230
			260
			280
	OPB PC PR DC		6
			130
			150
			170
			190
			210
			230
			260
			280

DATA PLOT LISTING FOR TEST STAND A1 (Continued)

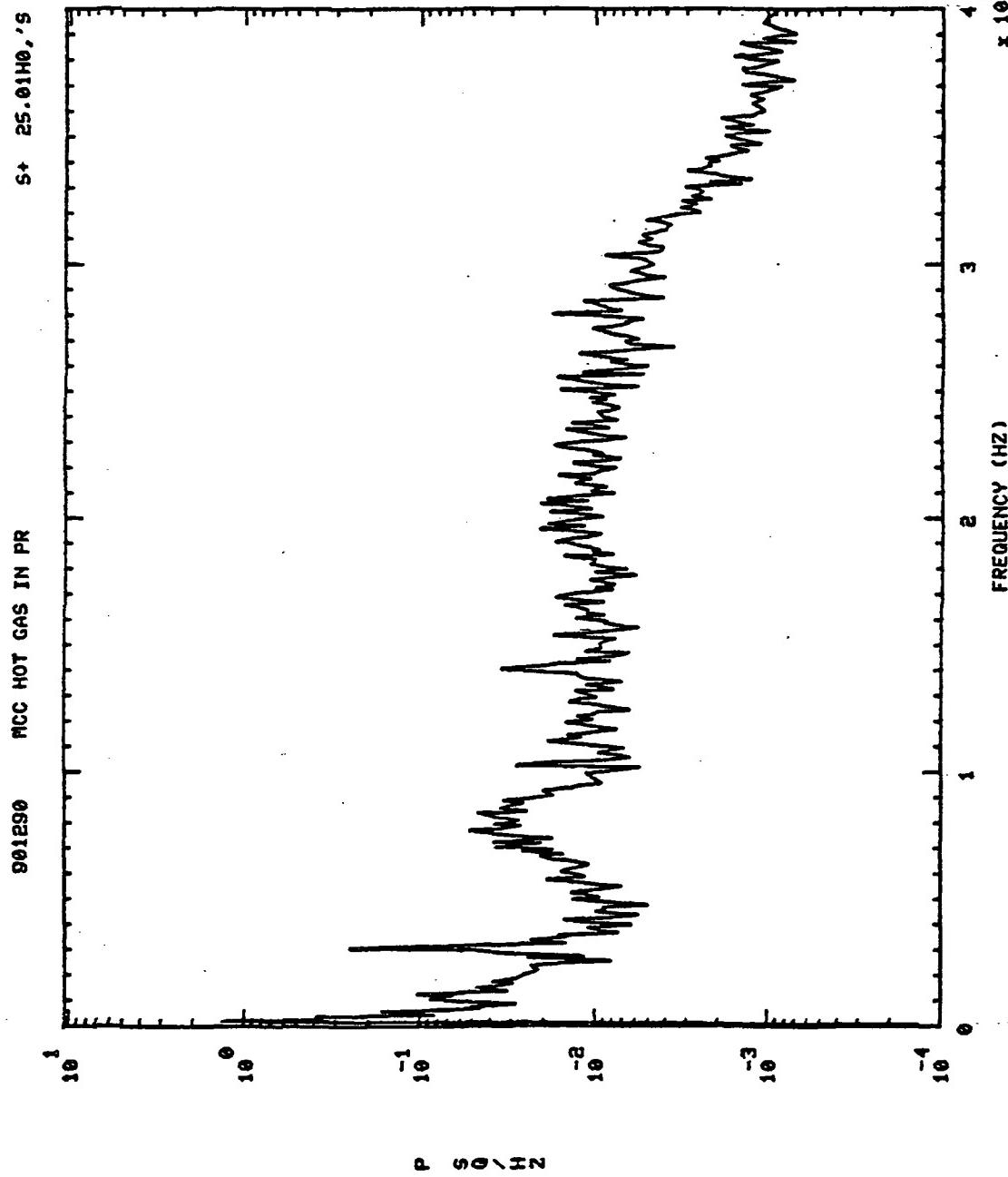
<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
384	THRUST		
385			
388			
389			
390			
391			
393			
394			
395			
397			
398			
400			
401			
402			
403			
404	HPOP BAL CAV PR2	20,000	20 100 220 20 100 220 20 100 220 20 100 220 20 100 220 20 100 220
	HPOP BAL CAV PR1		
	OPB PC PR		
	HPFP BAL CAV PR		
	FPB PC		
	THRUST		
405			
406			
407	HPOP BAL CAV PR2	20,000	20 45 75 200 400 430 20 45 75 200 400 430
	HPOP BAL CAV PR1		

DATA PLOT LISTING FOR TEST STAND A1 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
407	FPB PC	20,000	20 45 75 200 400 430
	OPB PC PR		20 45 75 200 400 430
	HPFP BAL CAV PR		20 45 75 200 400 430
408	THRUST		20 45 75 200 400 430
409	HPOP BAL CAV PR2	20,000	15 240 500 525 705 725
	HPOP BAL CAV PR1		15 240 500 525 705 725
	OPB PC PR		15 240 500 525 705 725
	HPFP BAL CAV PR		15 240 500 525 705 725

DATA PLOT LISTING FOR TEST STAND A1 (Concluded)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
409	FPB PC	20,000	7
			240
			500
			525
			705
			725
410	THRUST		
413			
414			



S+ 55.01H0, 'S

MCC HOT GAS IN PR

0
10⁻⁶

10⁻¹

10⁻²

10⁻³

10⁻⁴

10⁻⁵

P S G / HZ

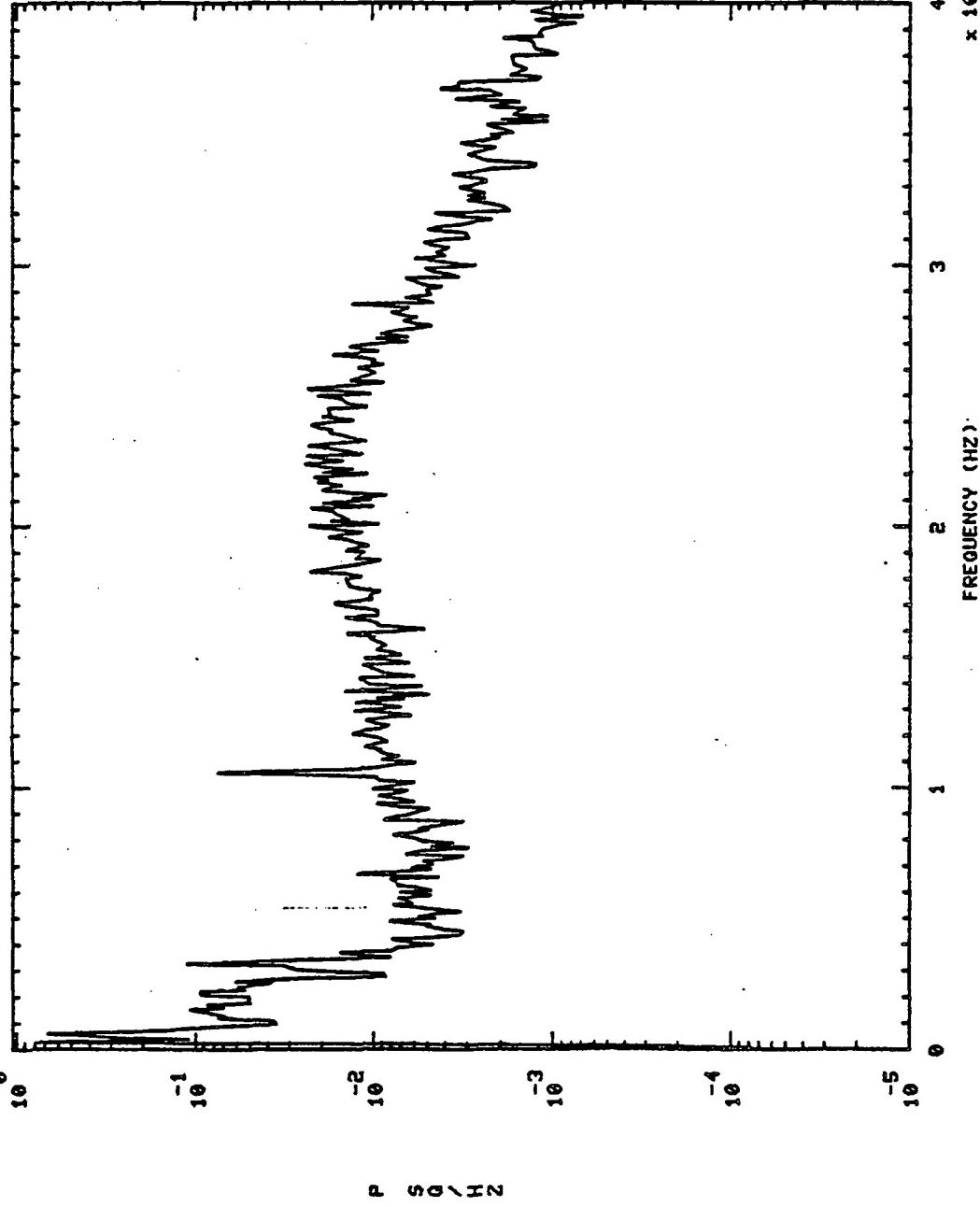
4
x 10⁻⁴

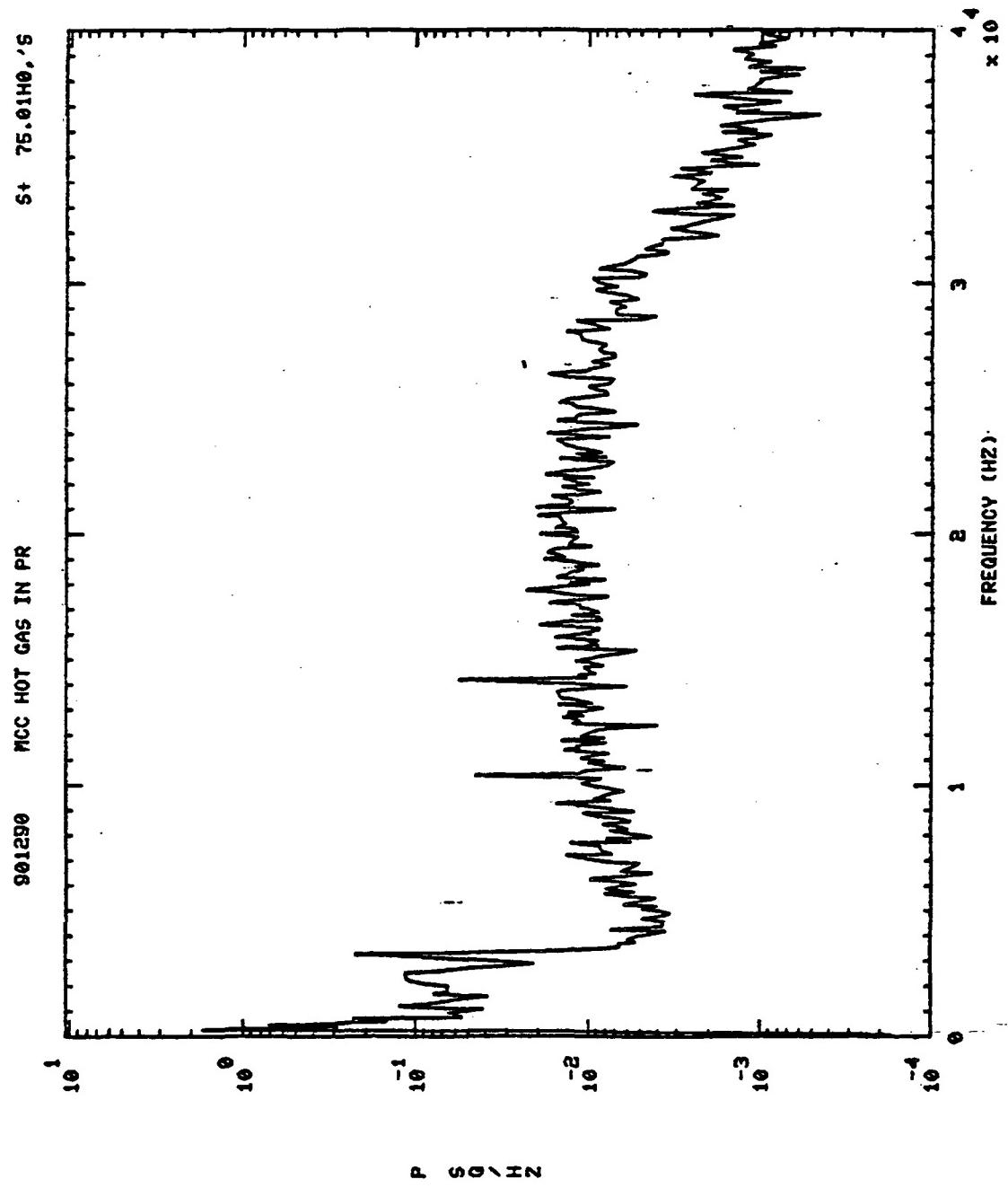
3

2

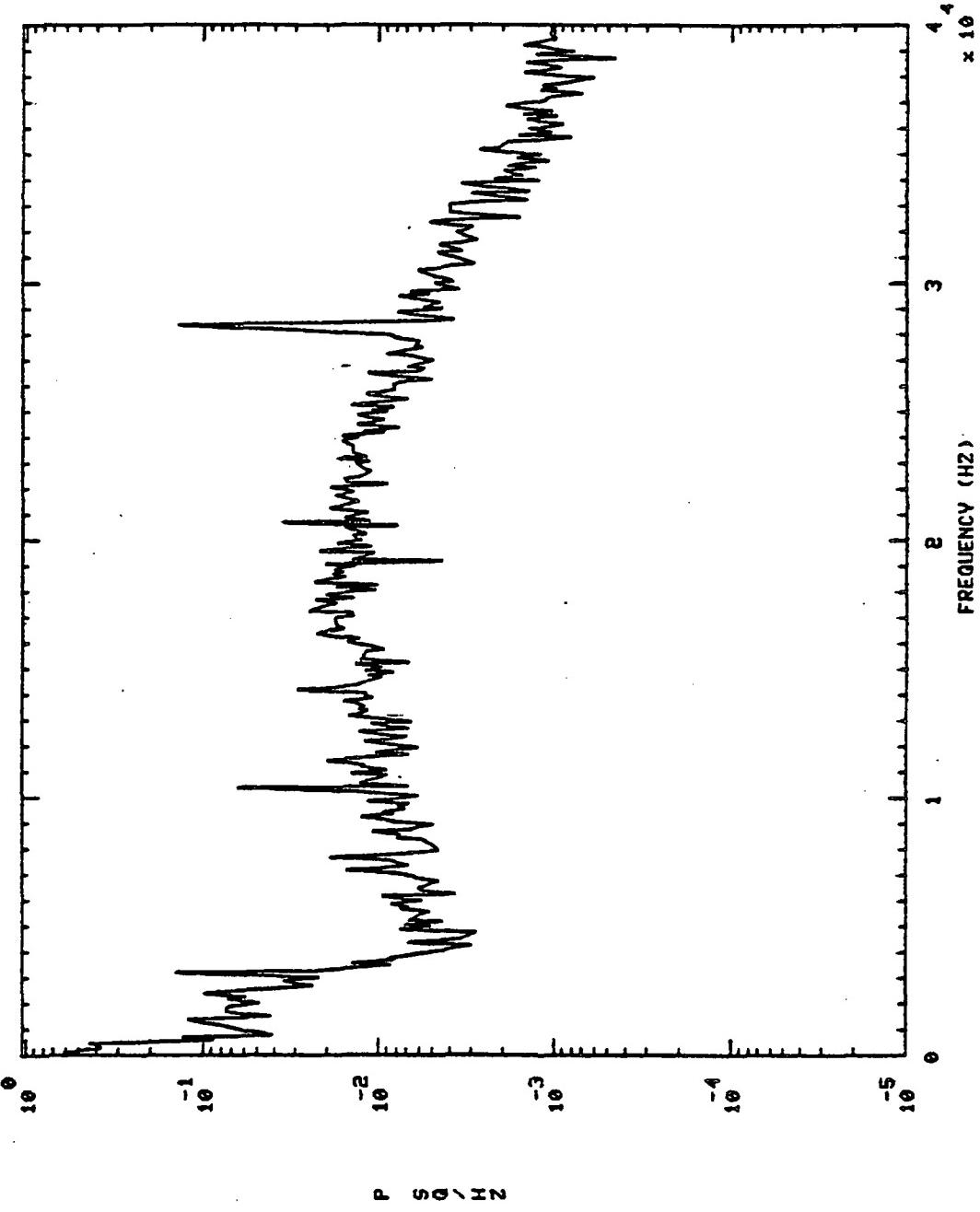
1

FREQUENCY (HZ)





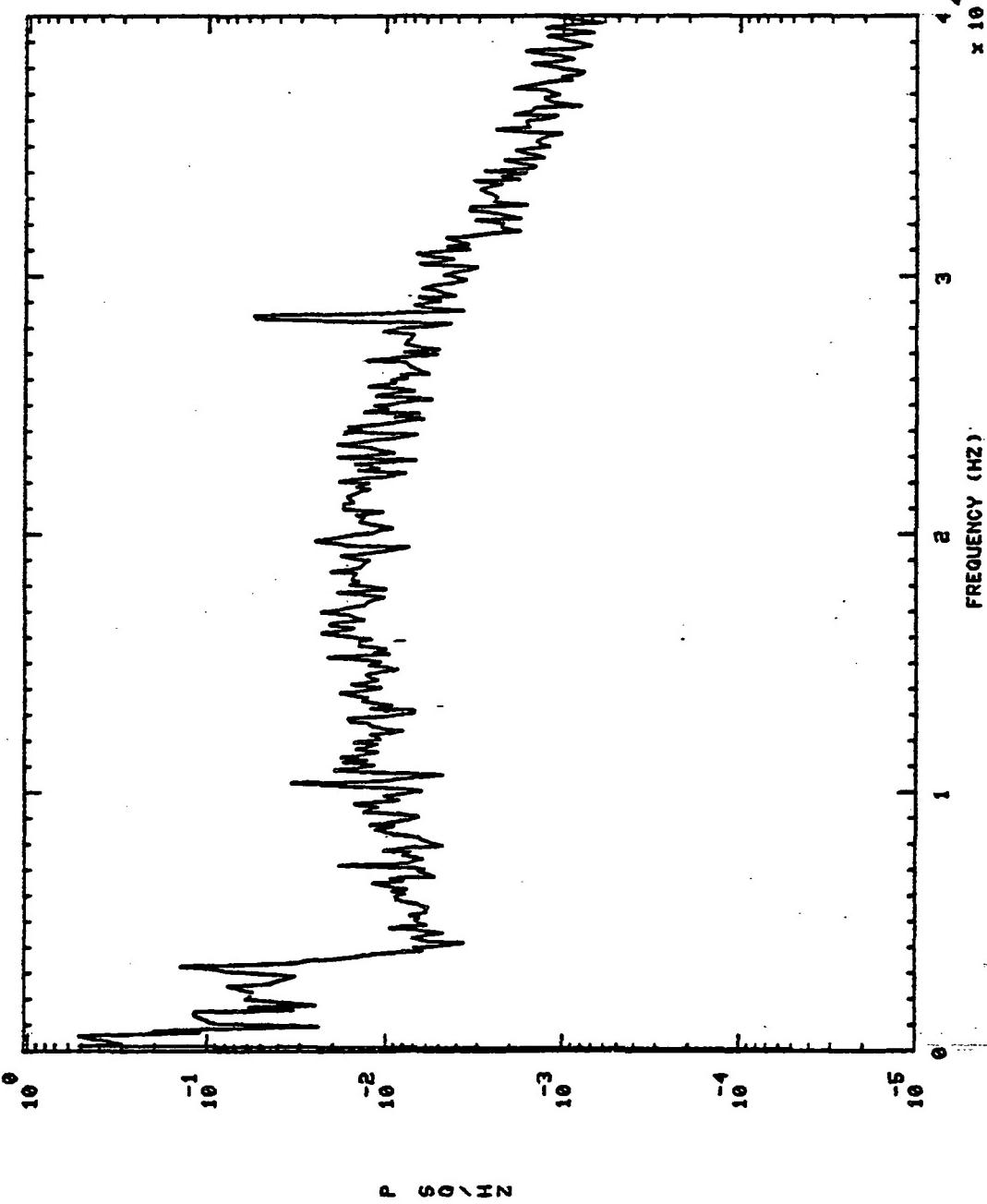
St 19501H015
901290 NCC HOT GAS IN PR



901290

MCC HOT GAS IN PR

S+ 315.01HQ, 'S

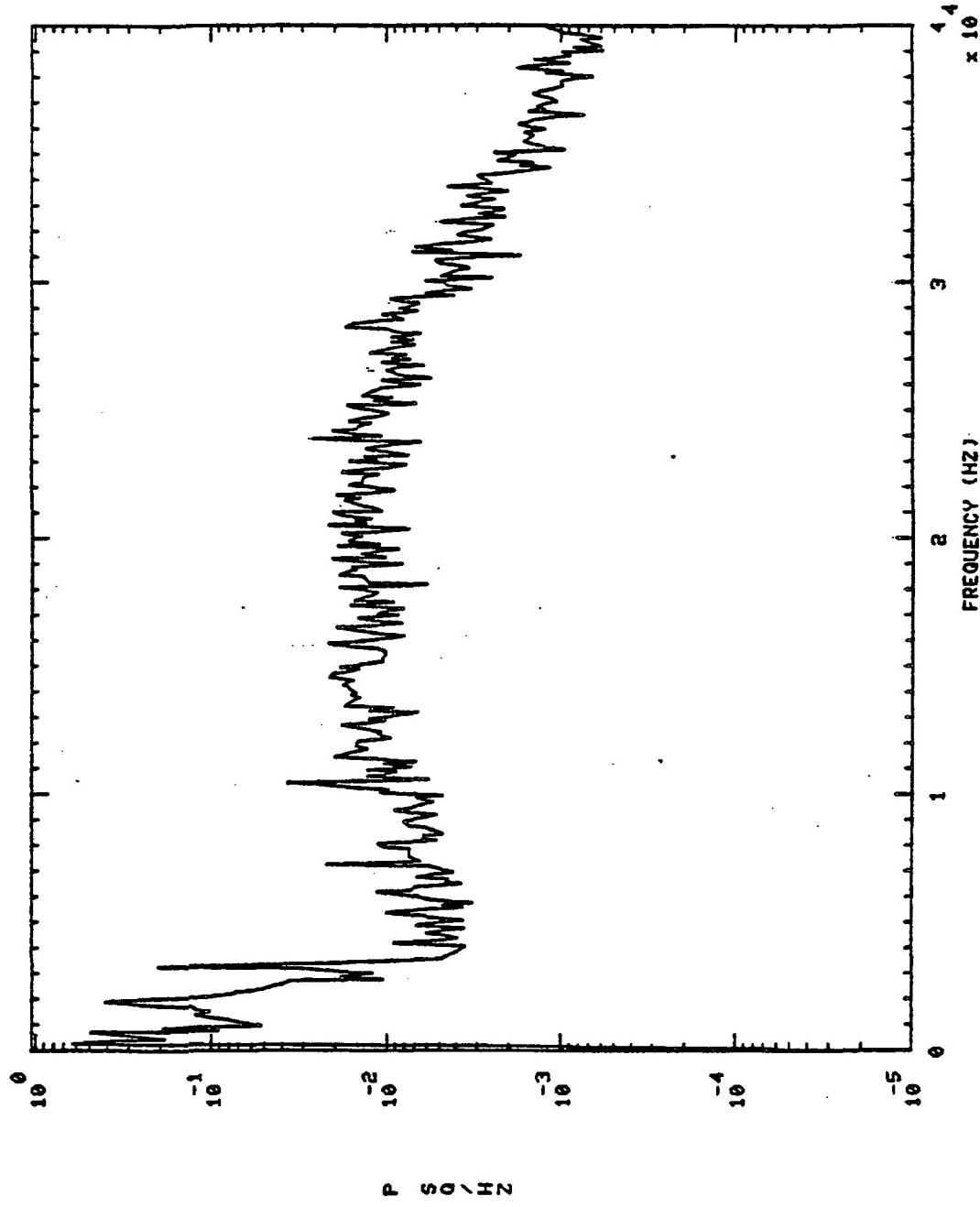


P 601Hz

50
20

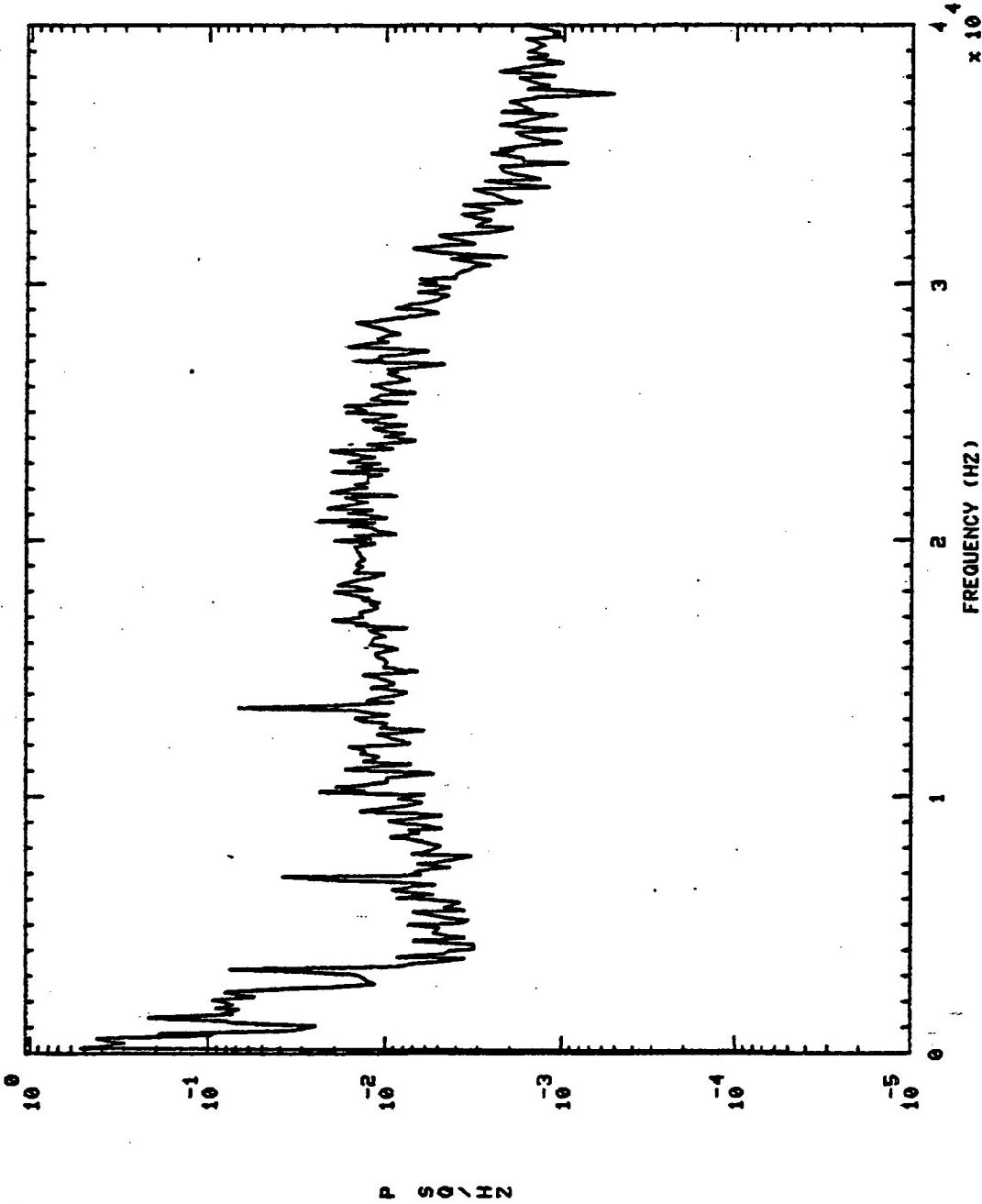
6+ 435.01H0. 'S

90190 MCC HOT GAS IN PR



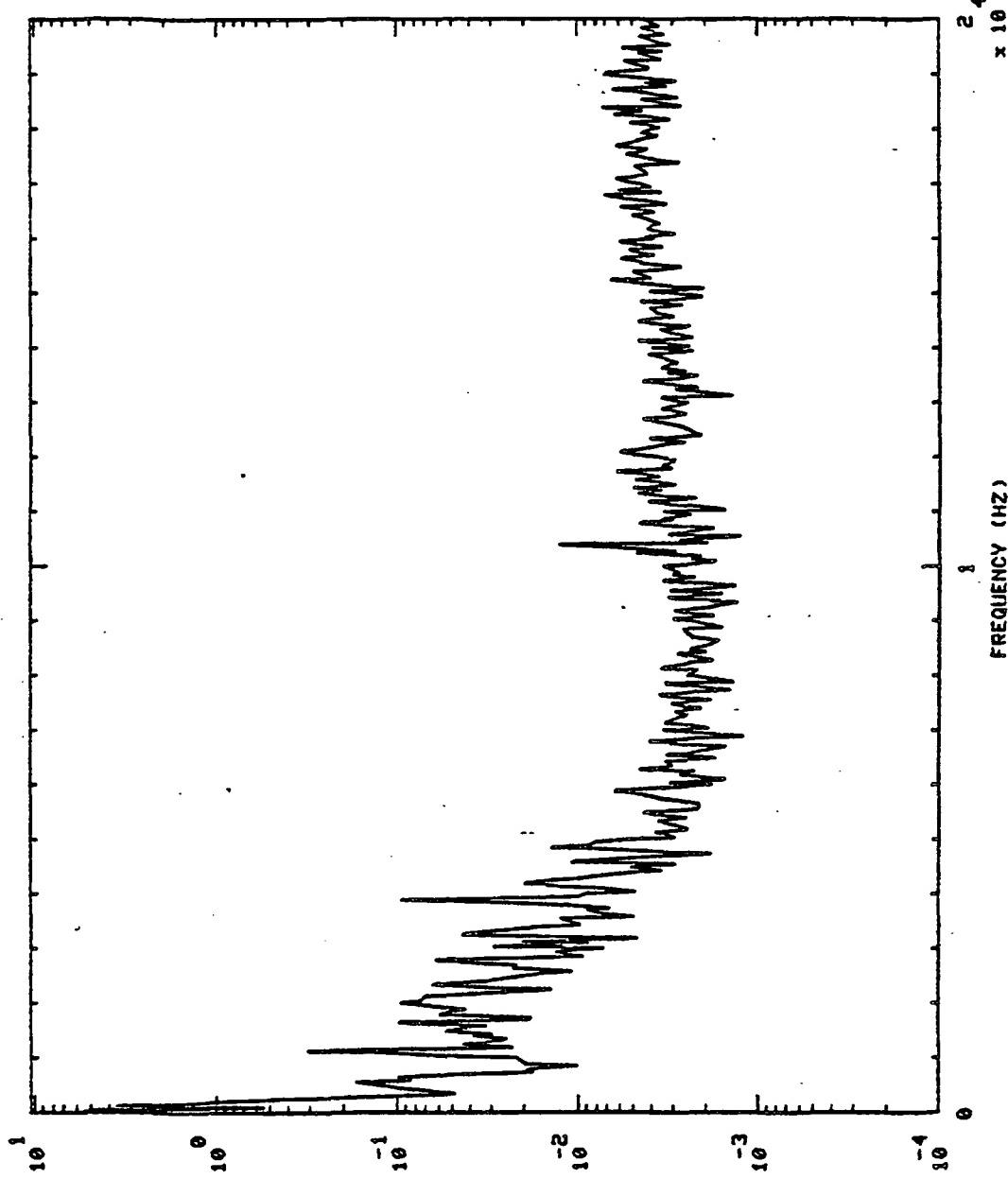
901890 RCC HOT GAS IN PR

S+ 500.01H0.'S

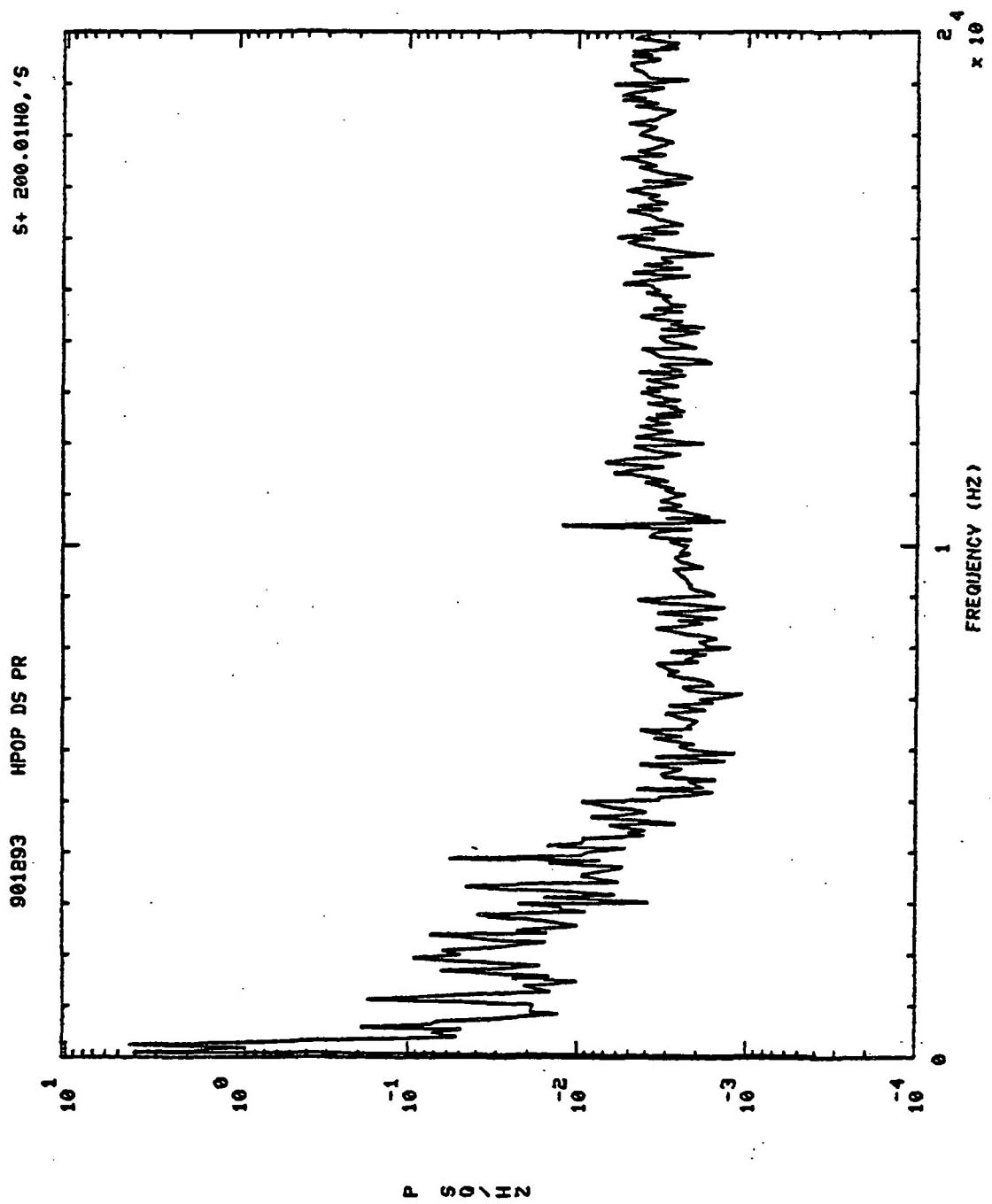


5+ 10.01H0, 'S

901293 HPOP DS PR



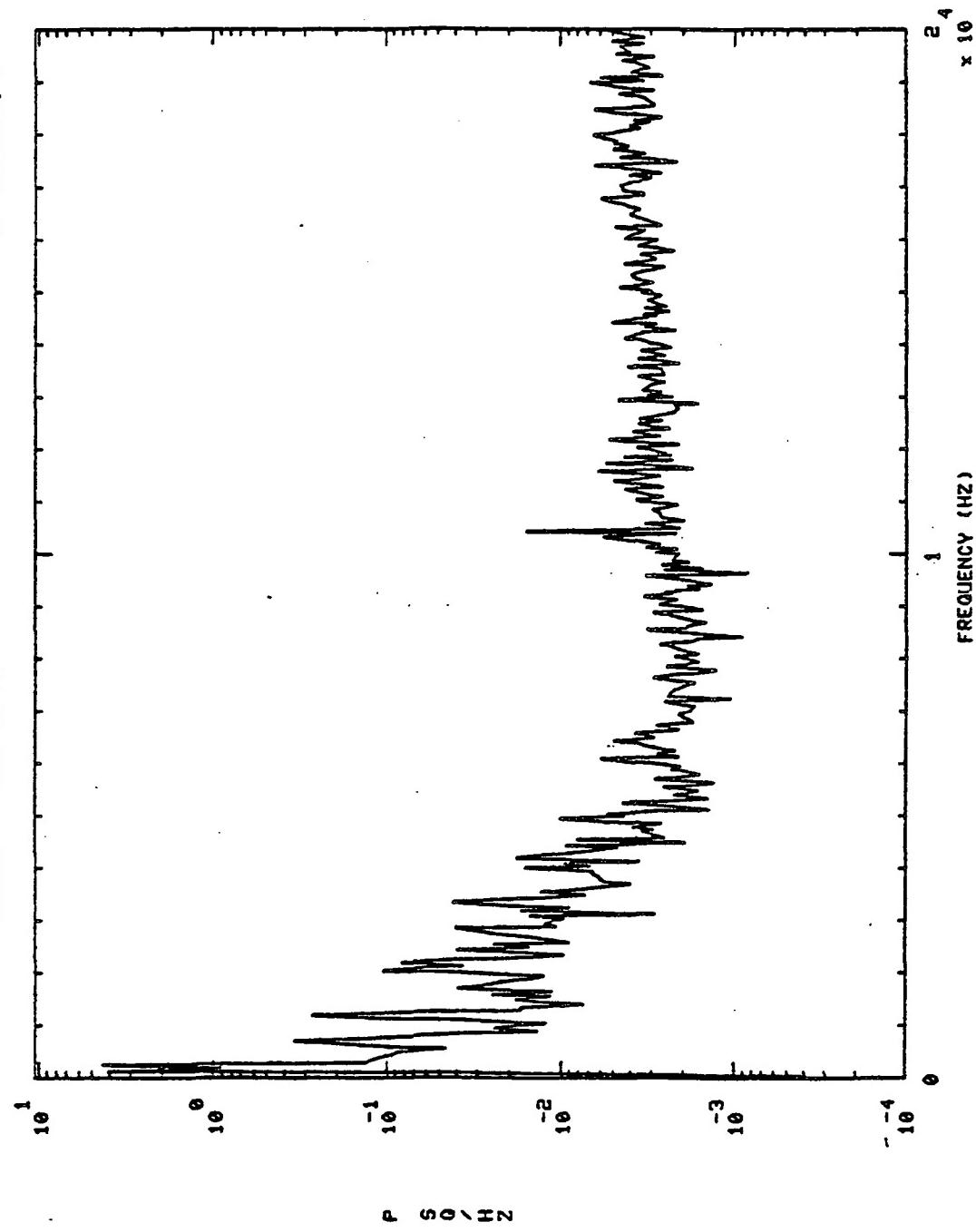
P S Q / HZ

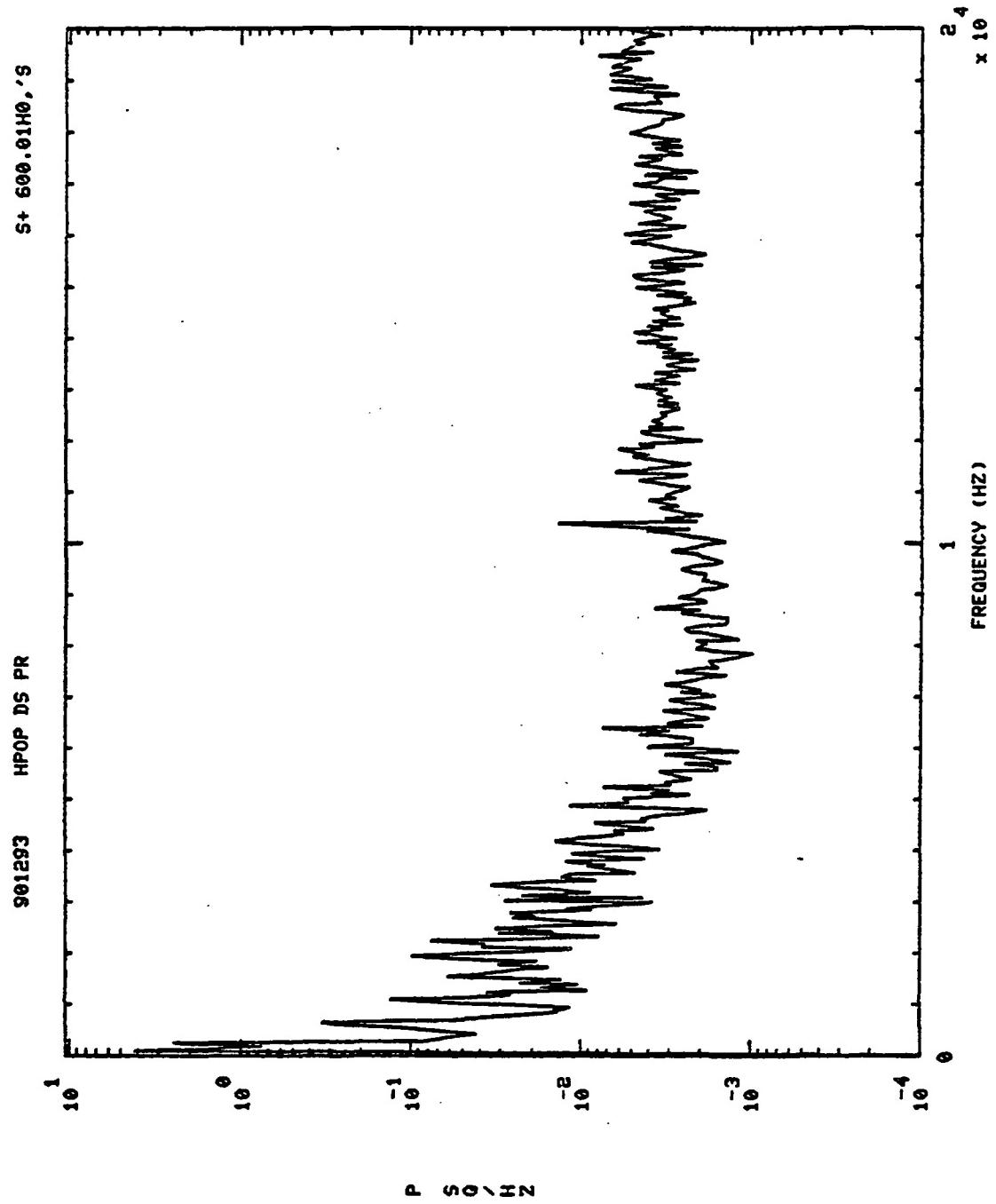


901293

HPOP DS PR

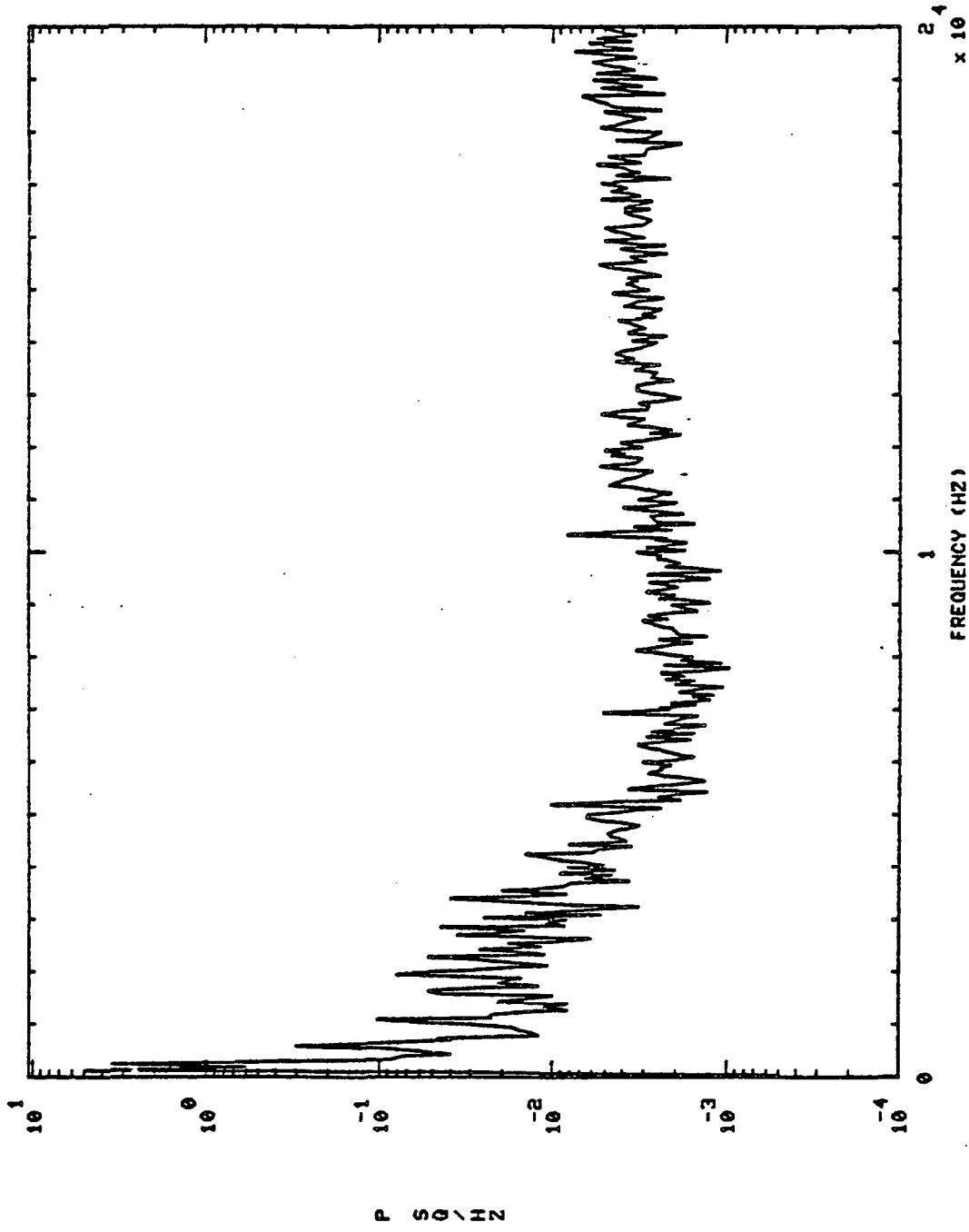
S+ 400.01Hz, 'S

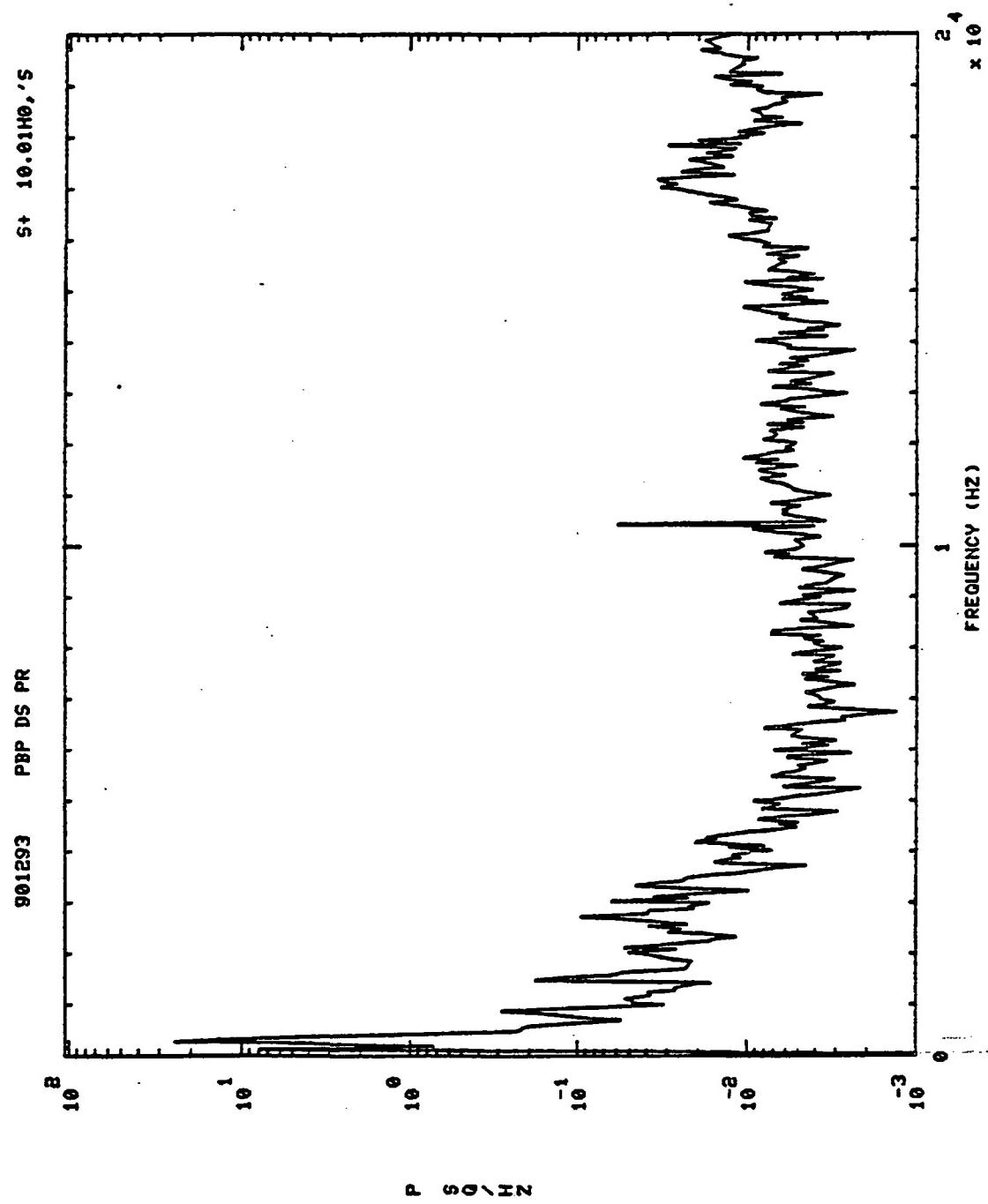




S+ 800.01H0, 'S

901293 HP0P DS PR

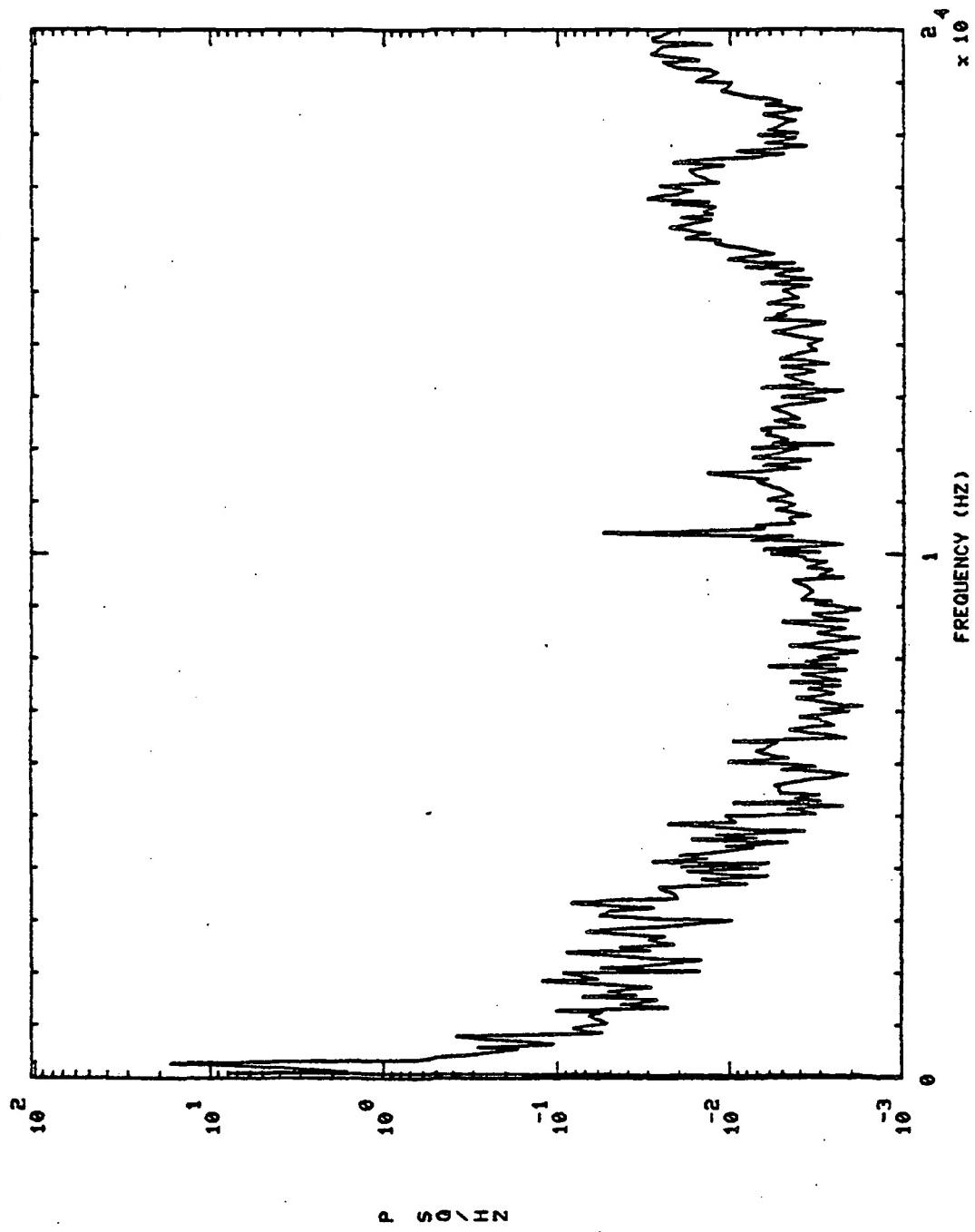


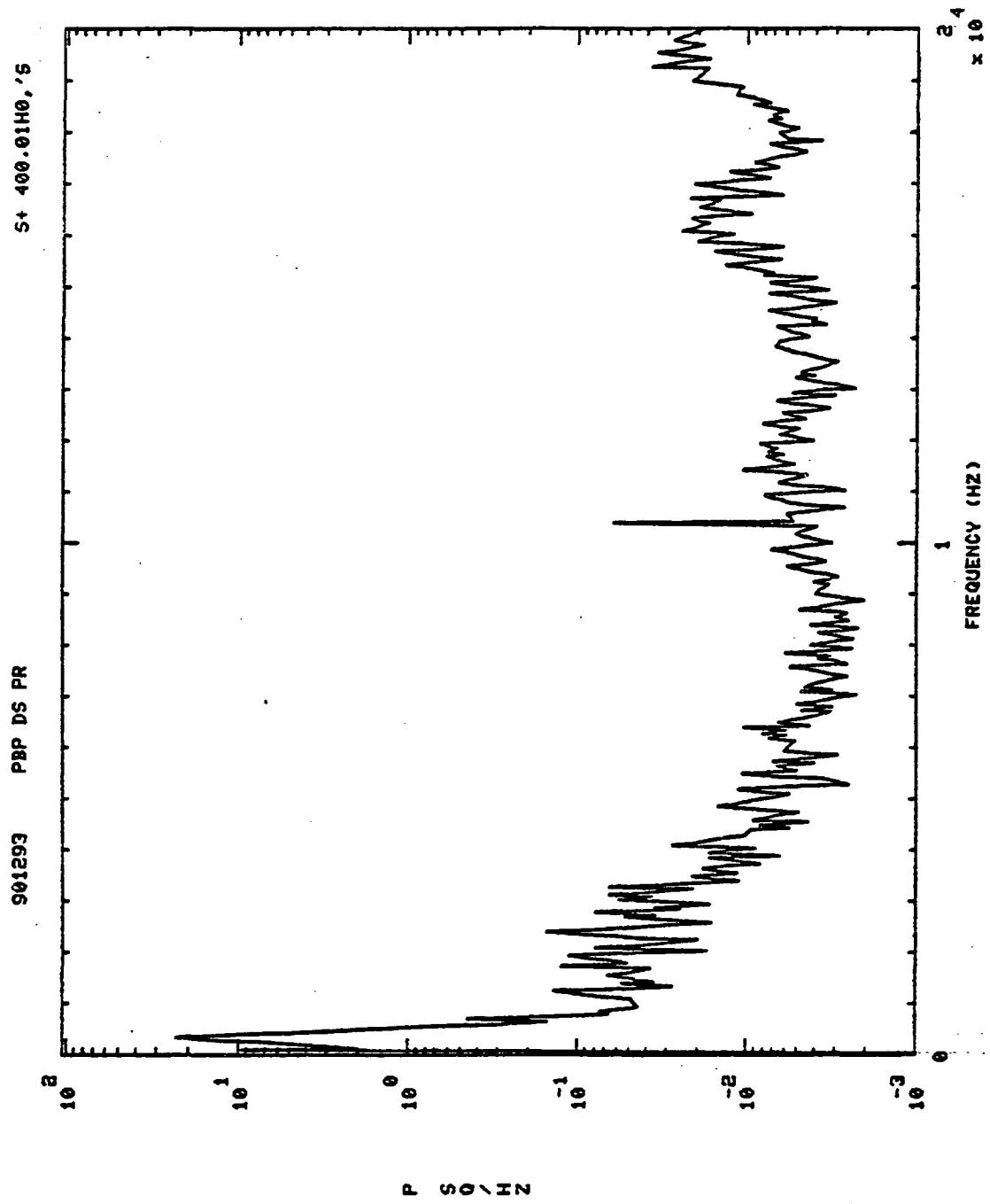


901293

PBP DS PR

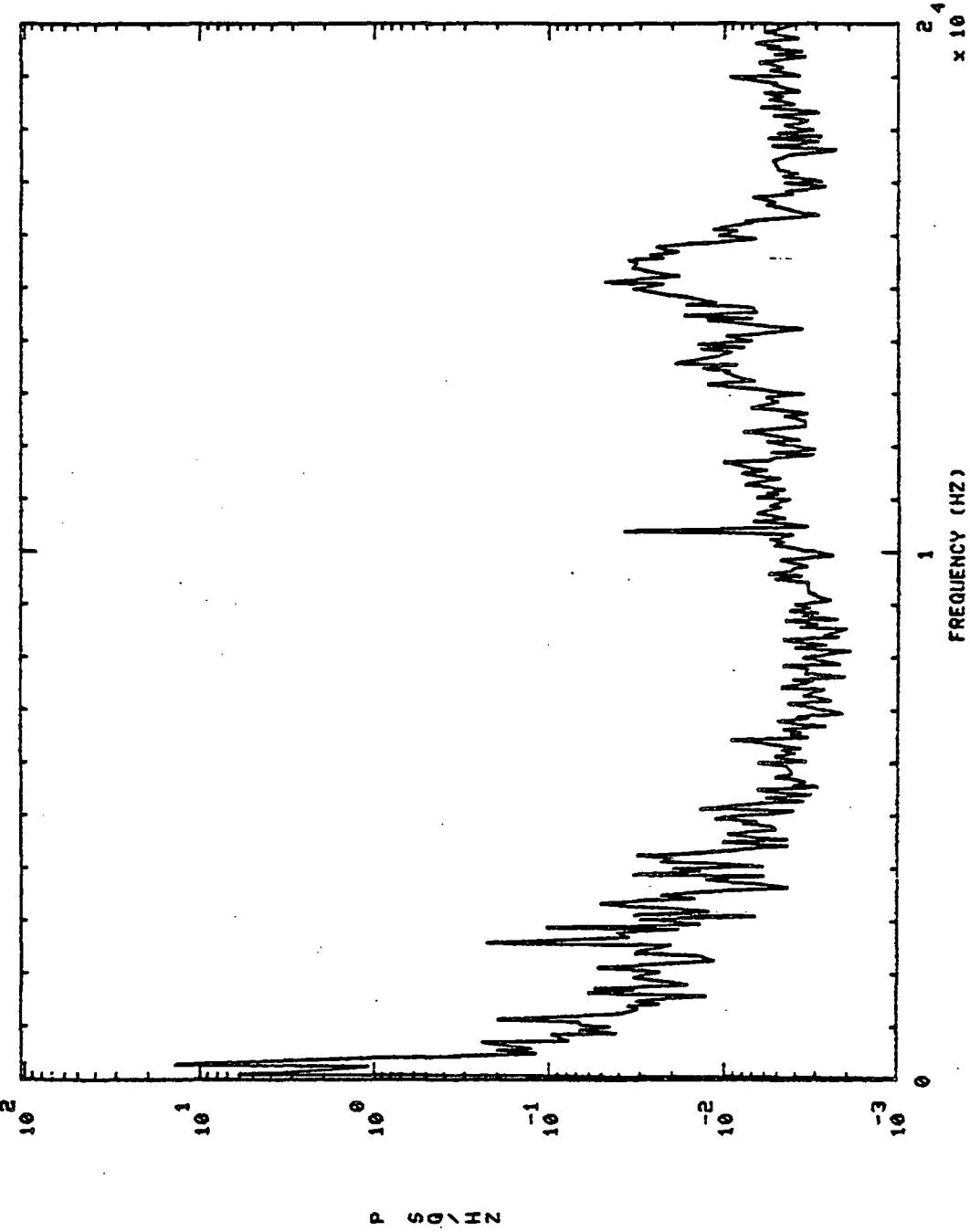
S+ 200.01H0.'S

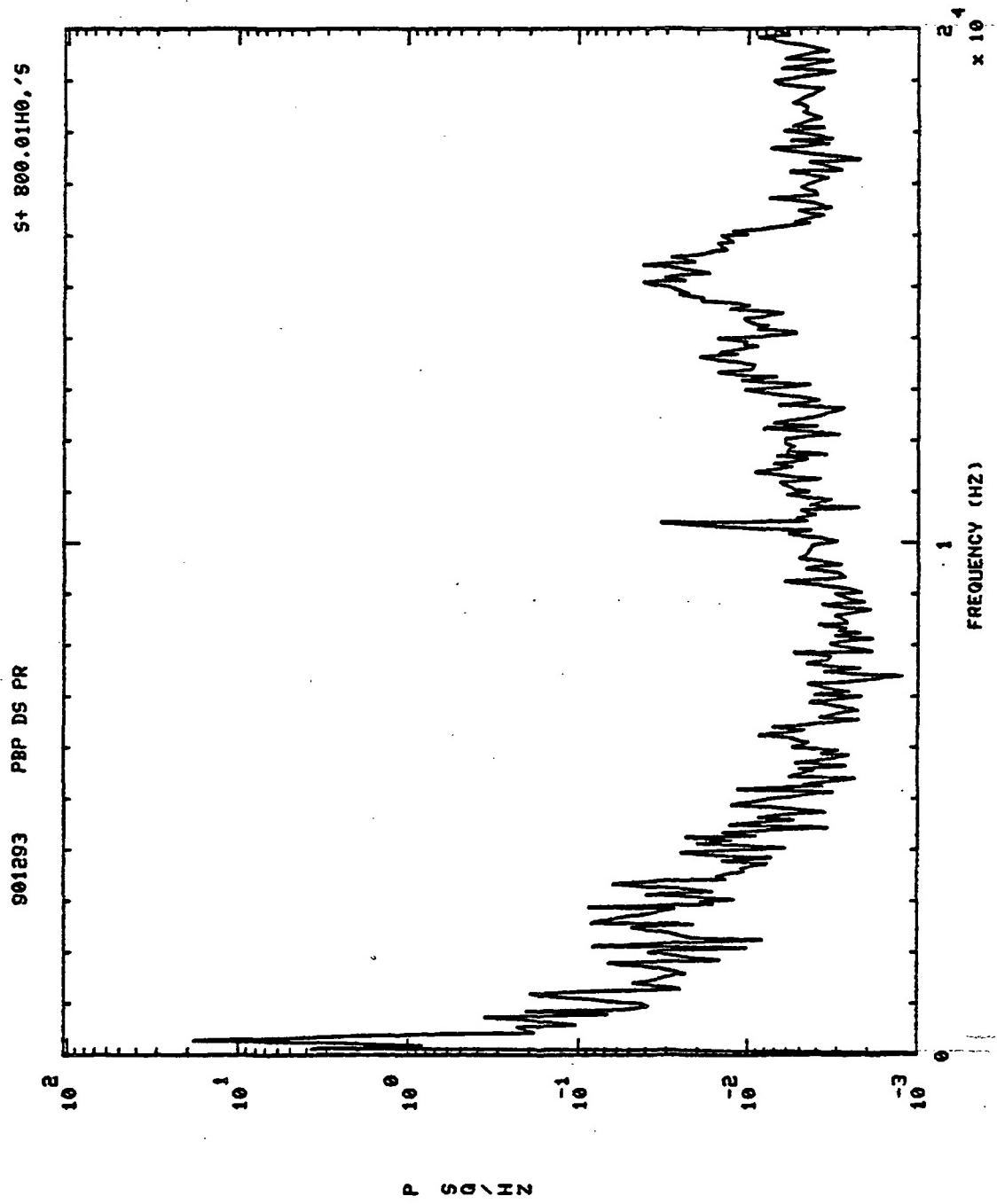




901293 PBP DS PR

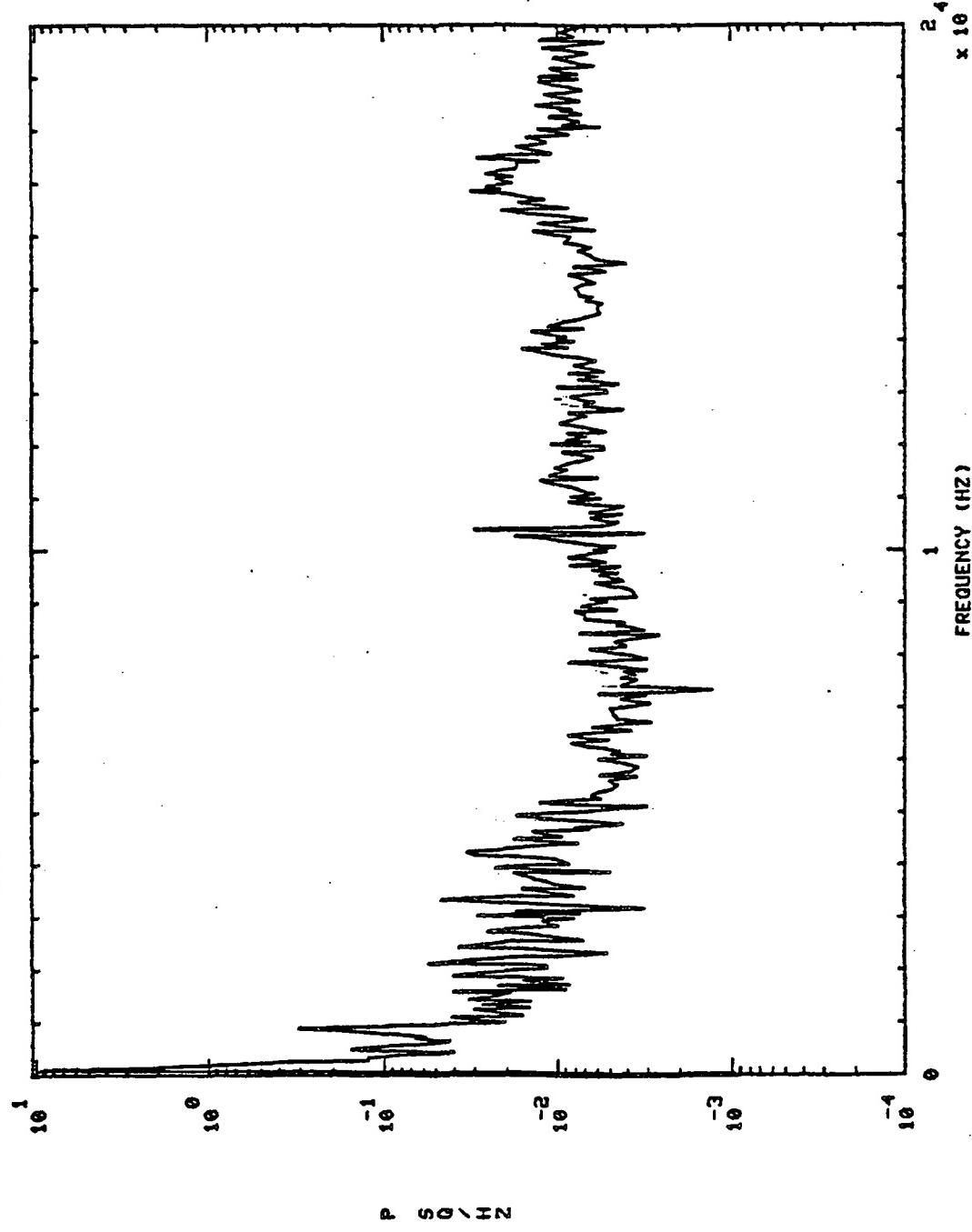
S+ 600.01H0.'5

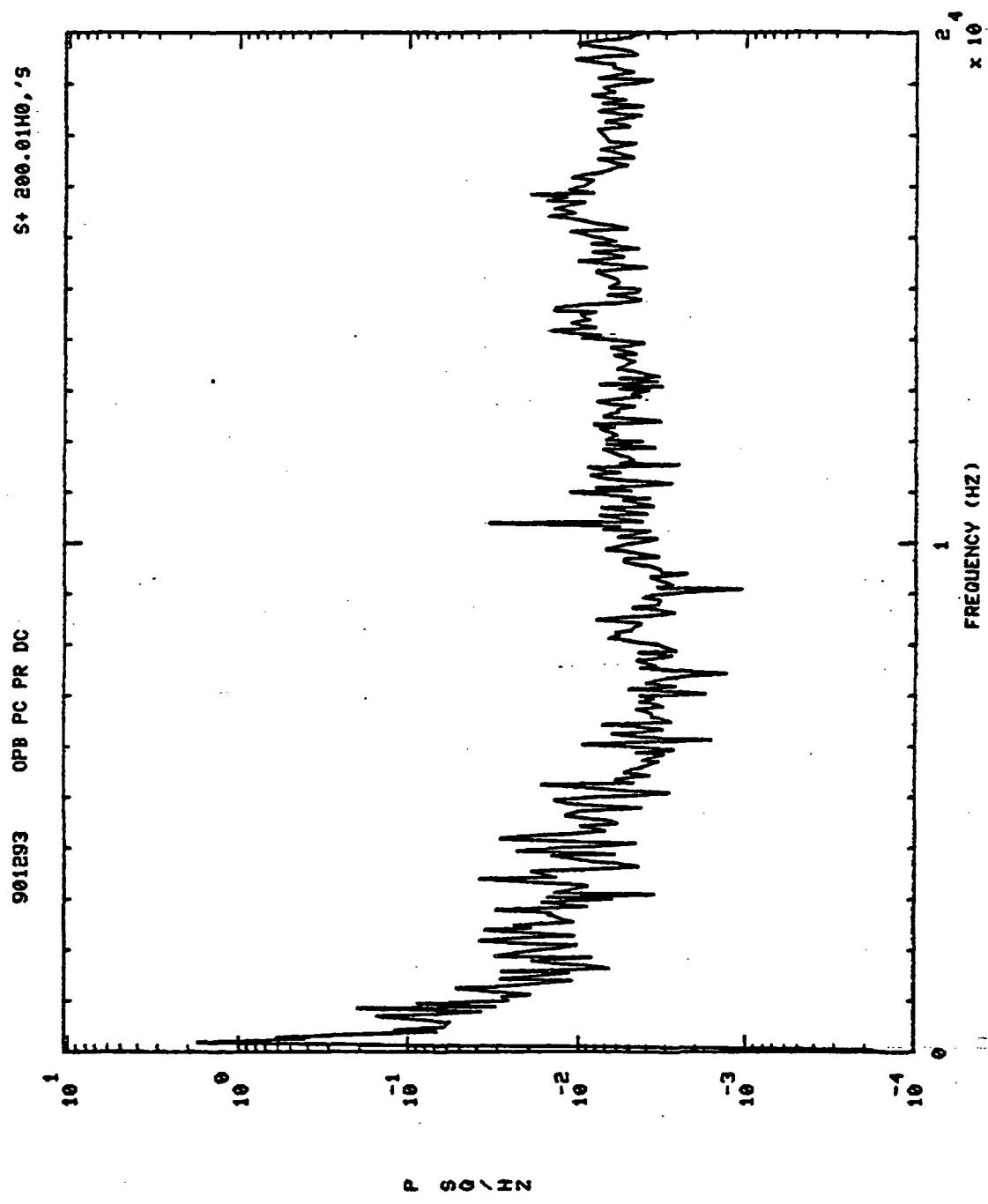




S + 10.0

901293 0PB PC PR DC

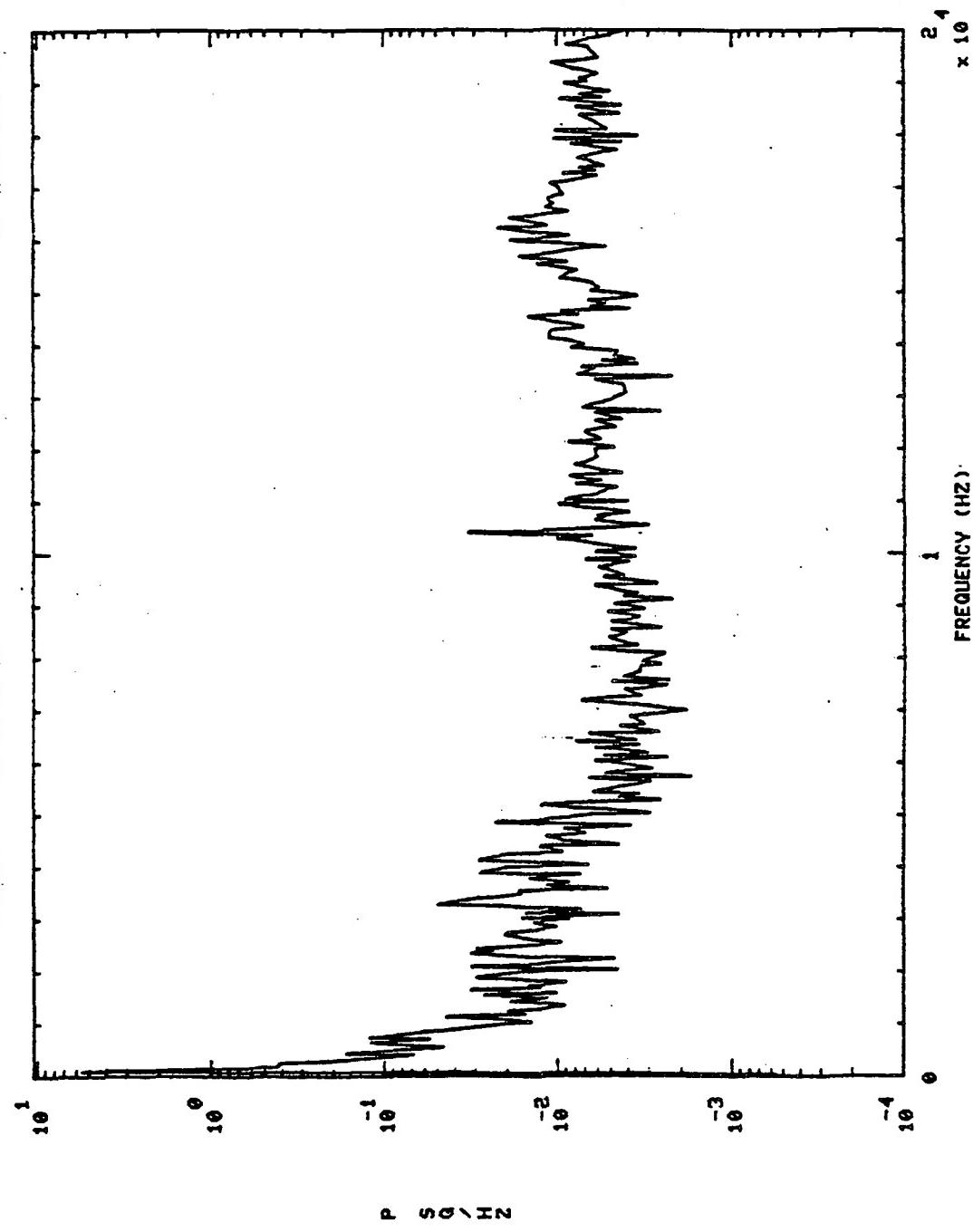




5+ 400.01Hz, S

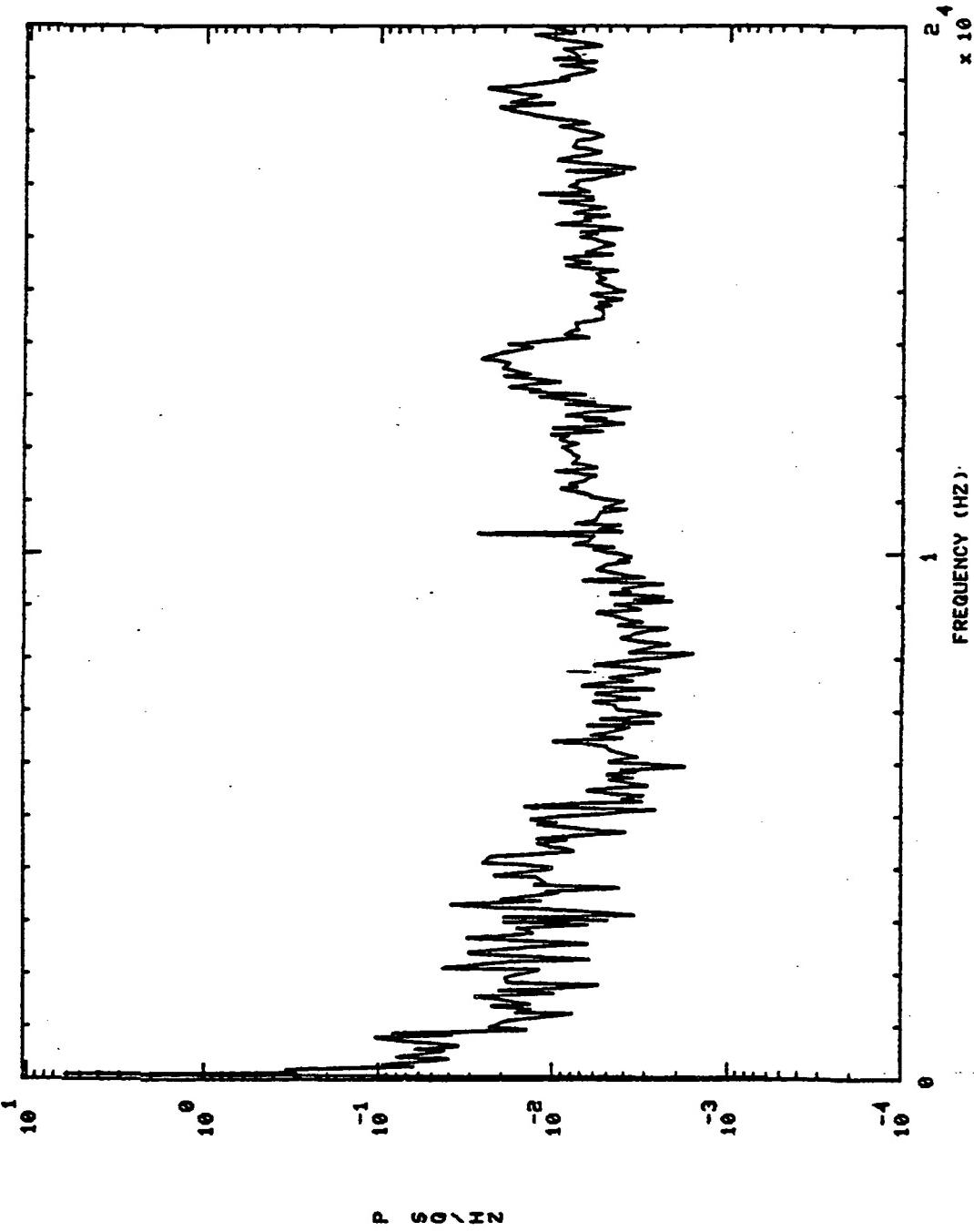
OPB PC PR DC

801293



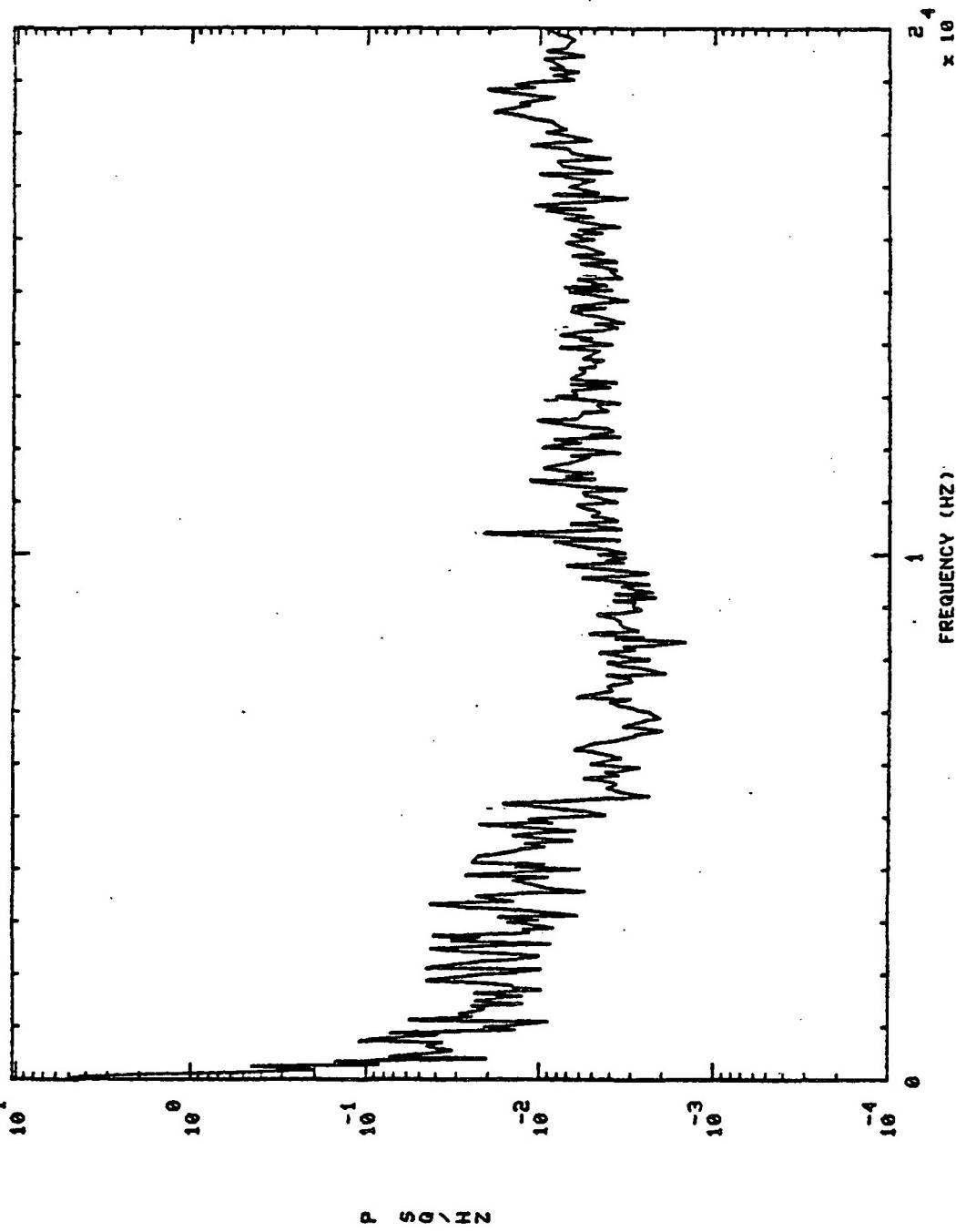
901293 : OPB PC PR DC

S+ 600.01H0, 'S



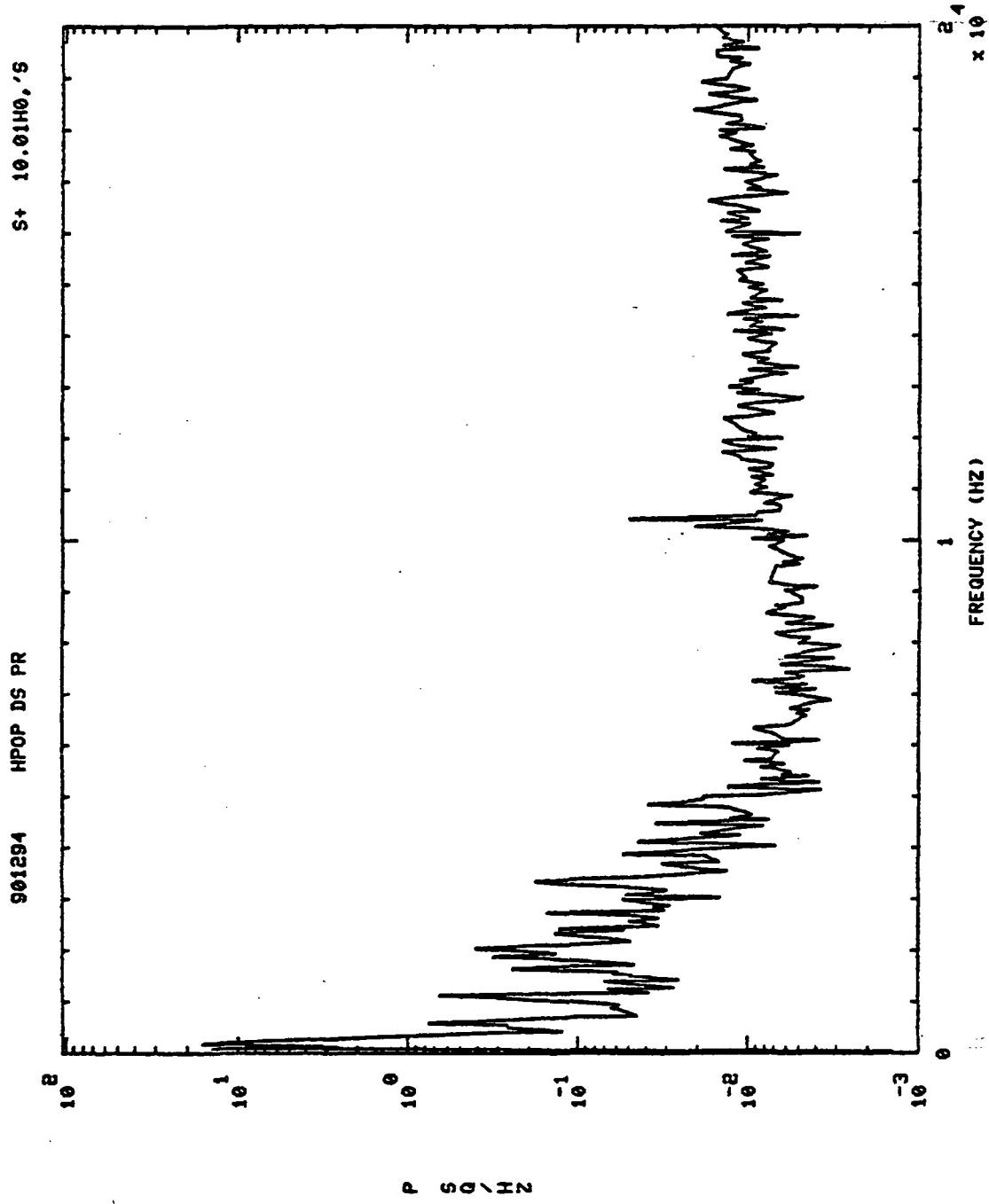
S+ 800.01H0.'S

901293 OPB PC PR DC



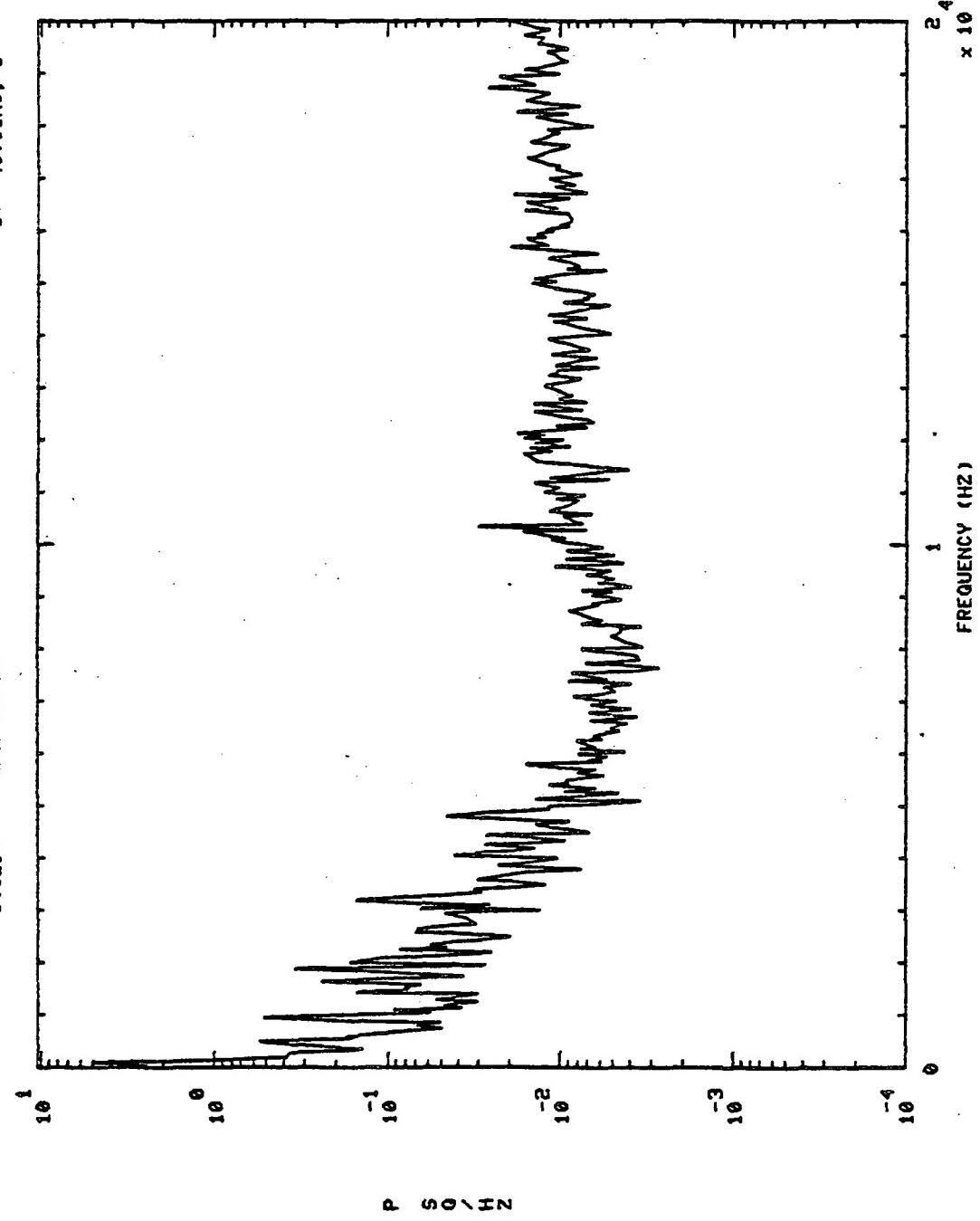
P S G/HZ

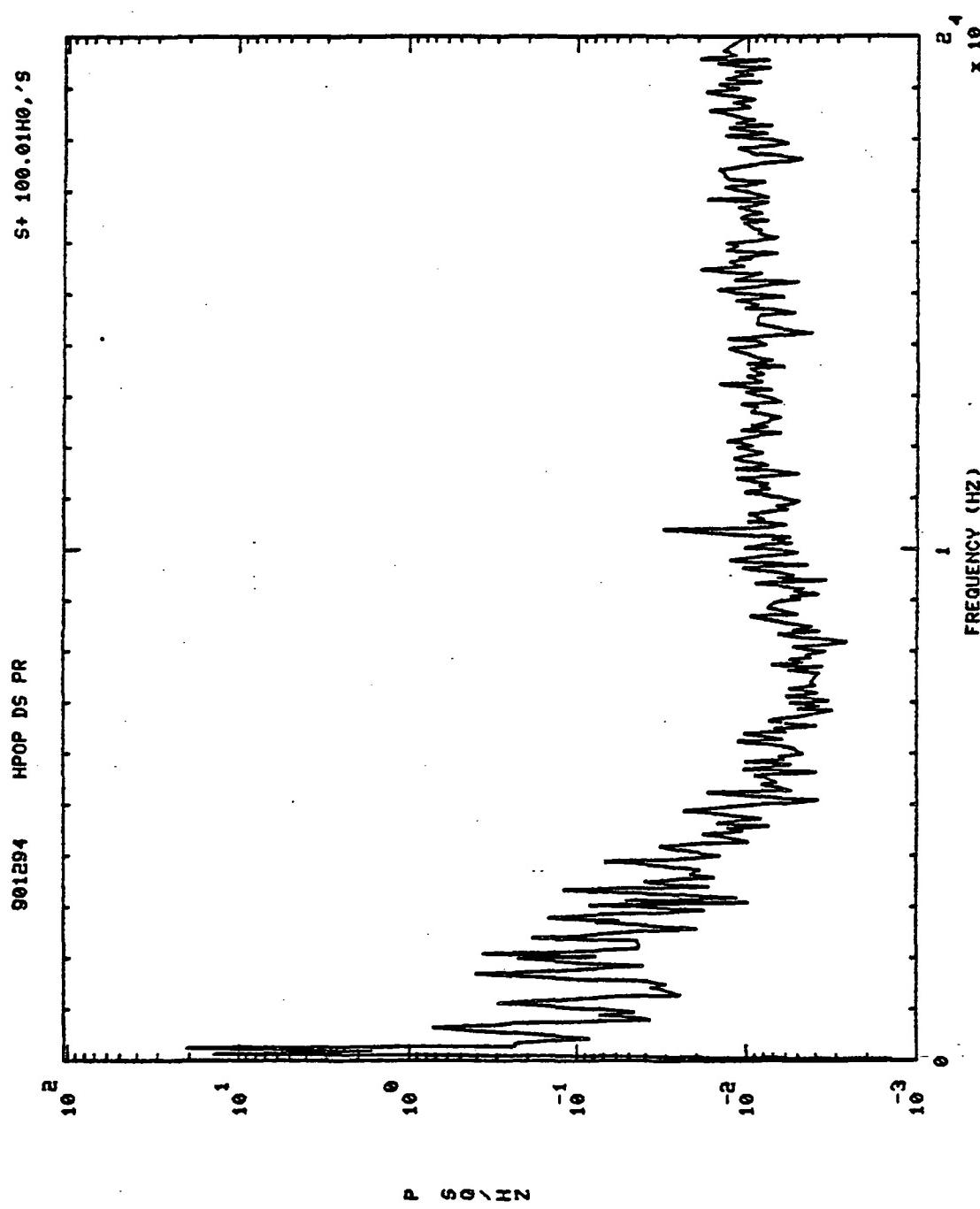
603



S+ 40.01H0, 'S

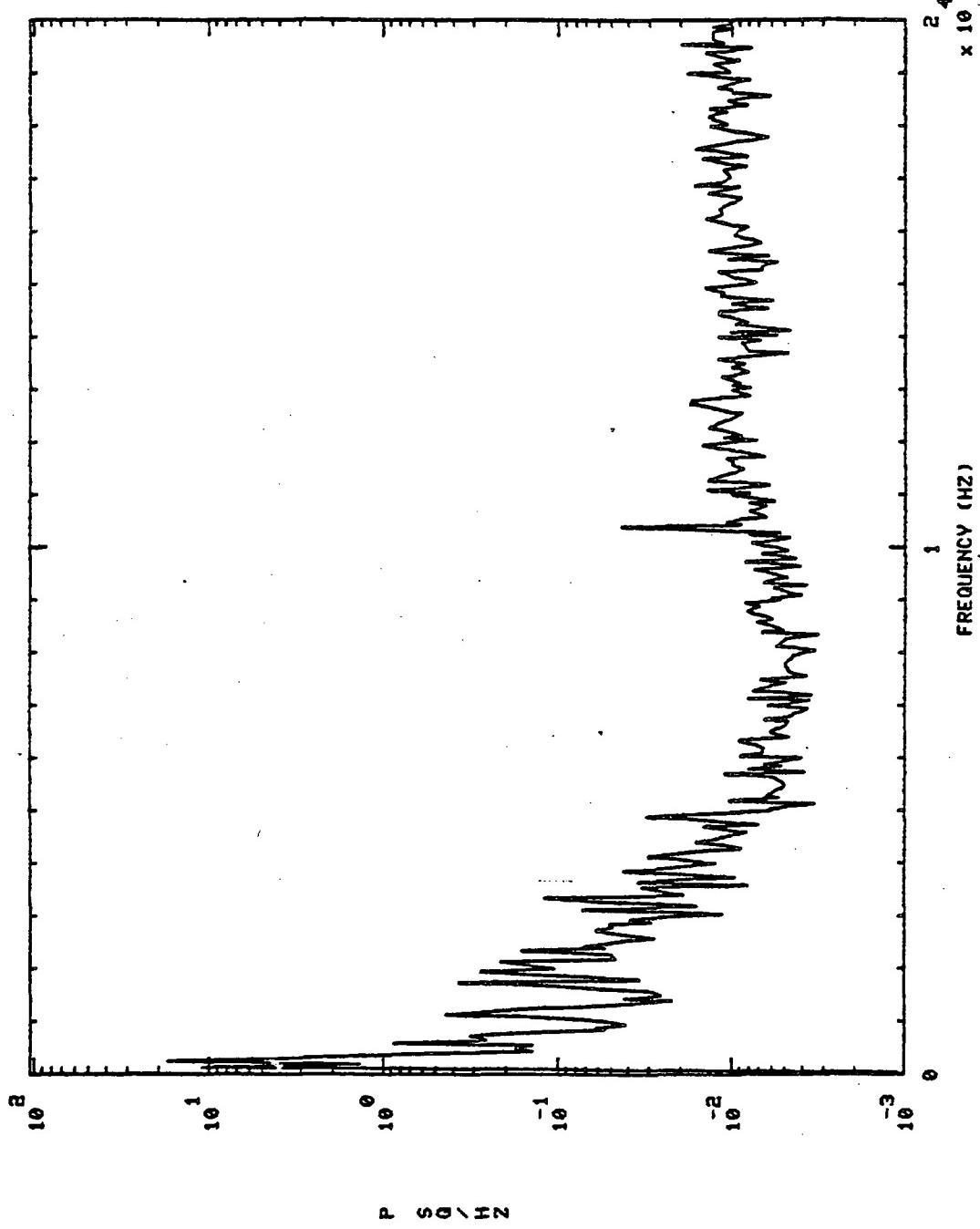
961294 HPOP DS PR

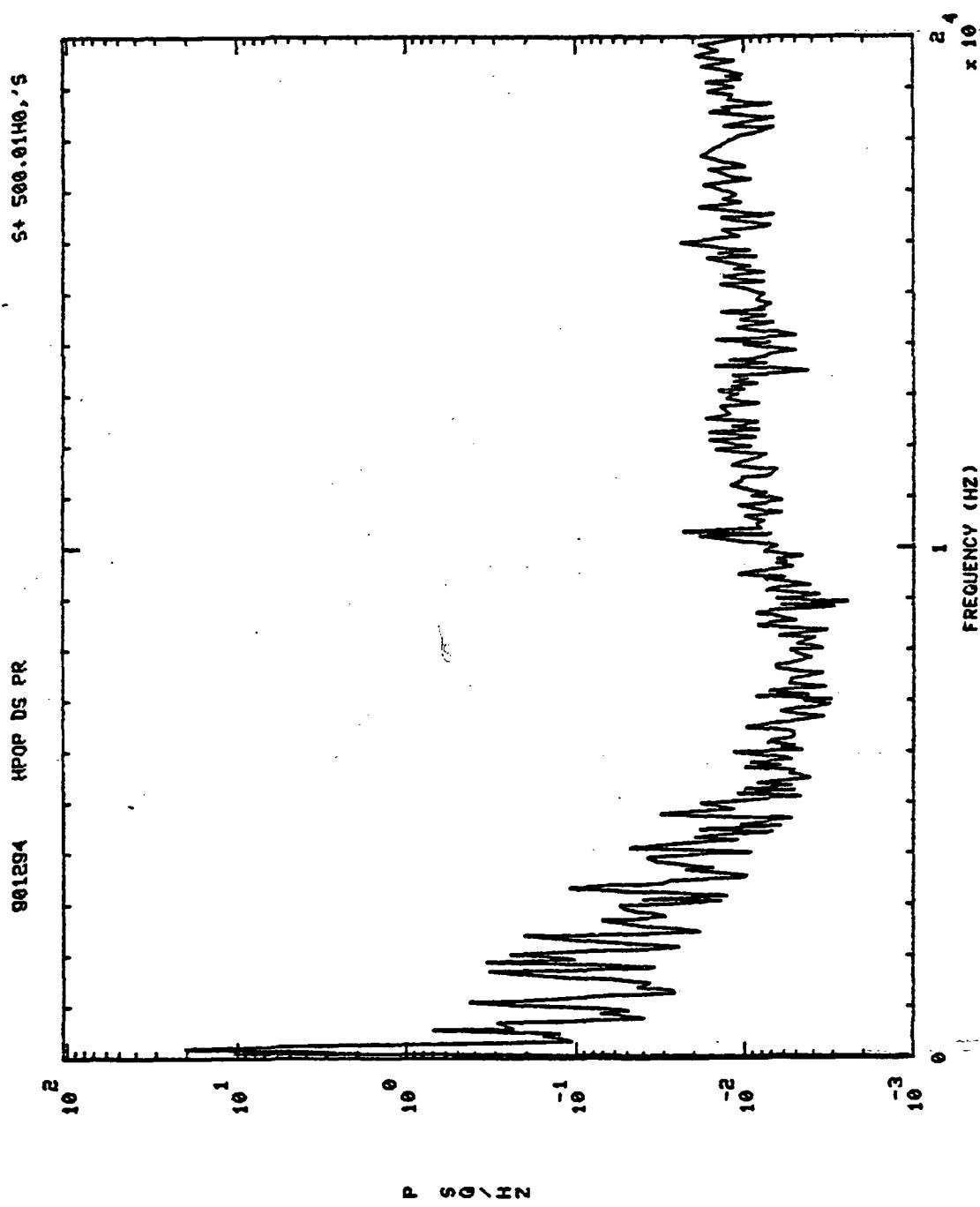




S+ 300.01H0.'S

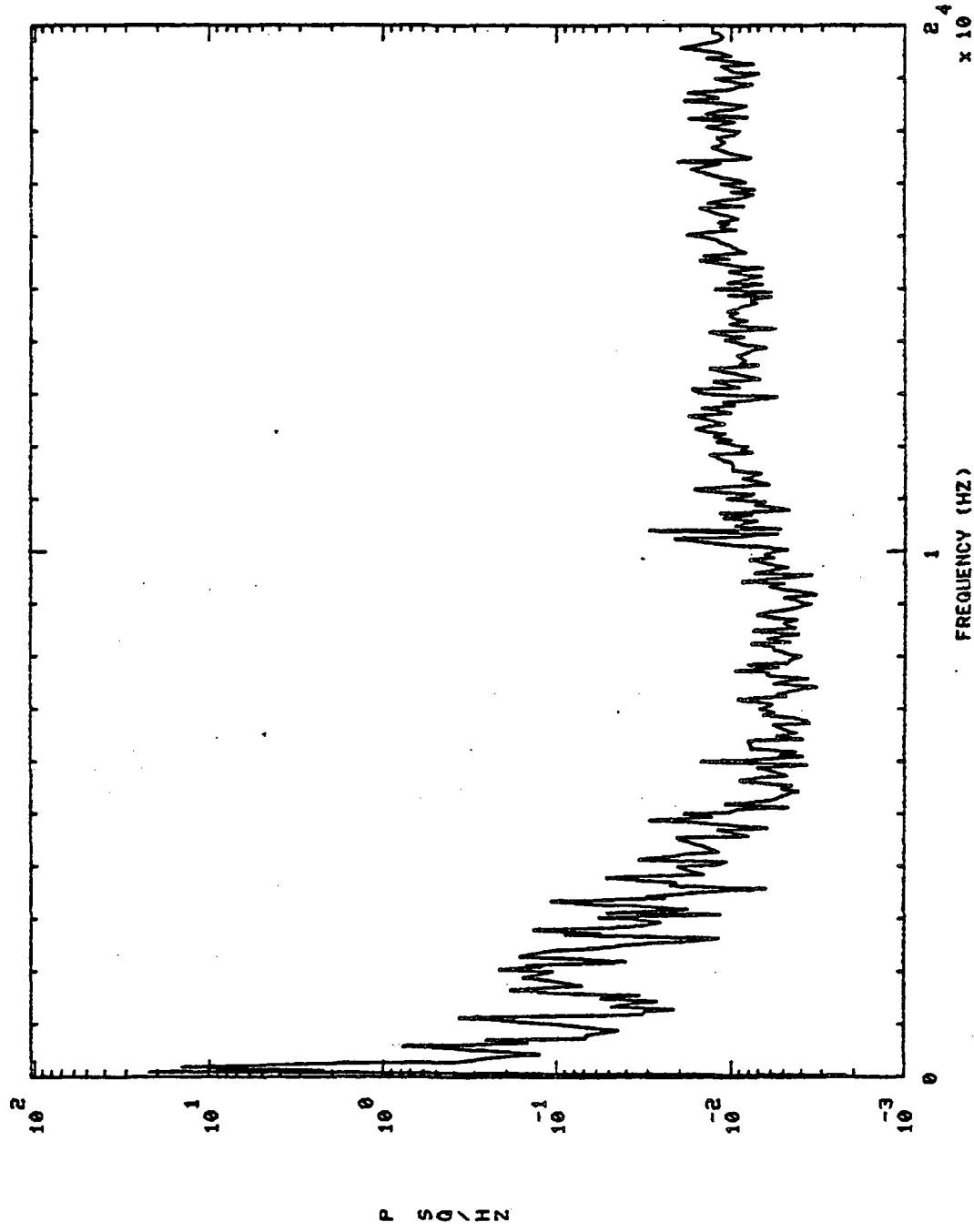
HP0P DS PR
901294





901294 HPOP DS PR

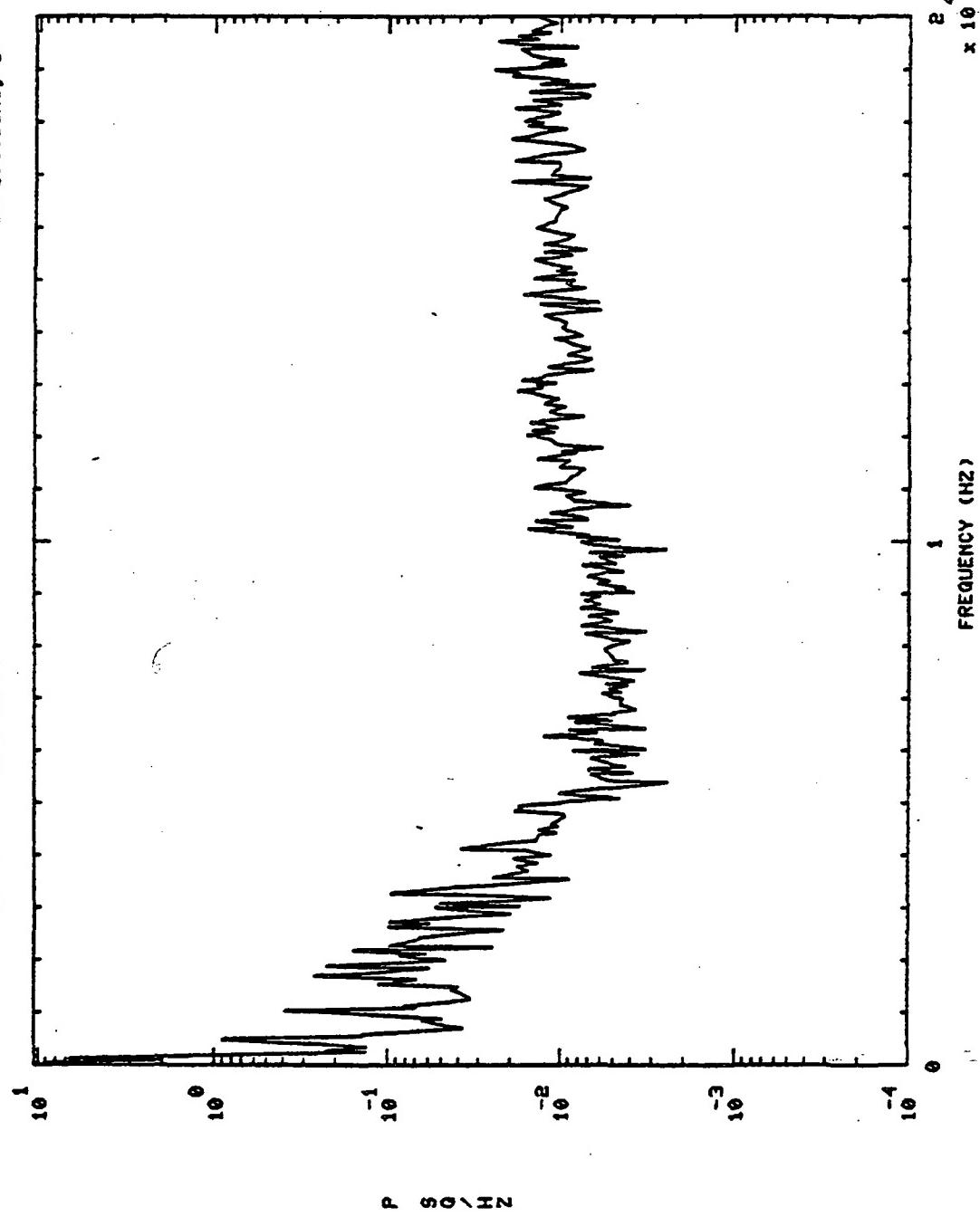
S+ 645.01Hz, 's



801294

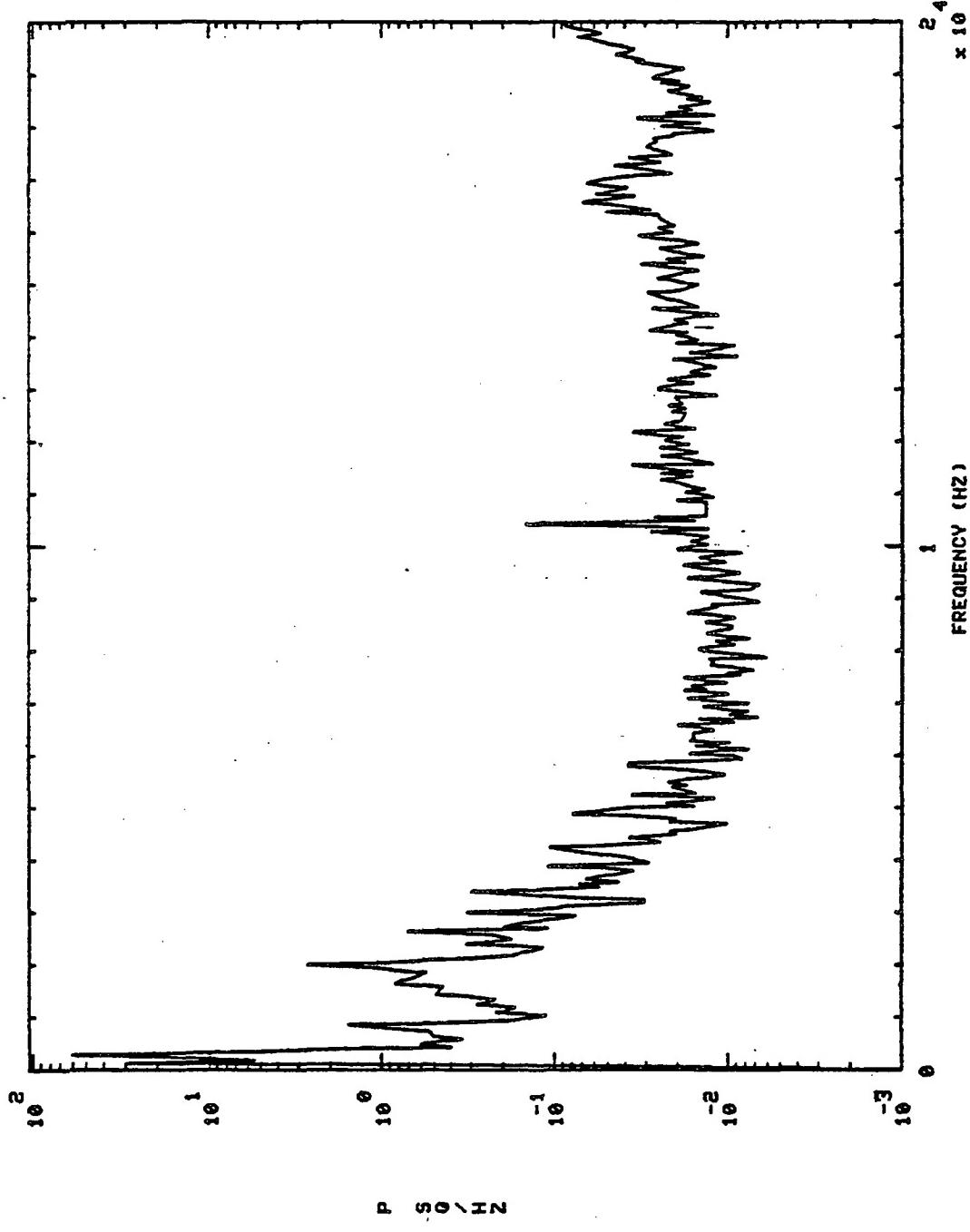
HPOP DS PR

S+ 660.01H0.'S

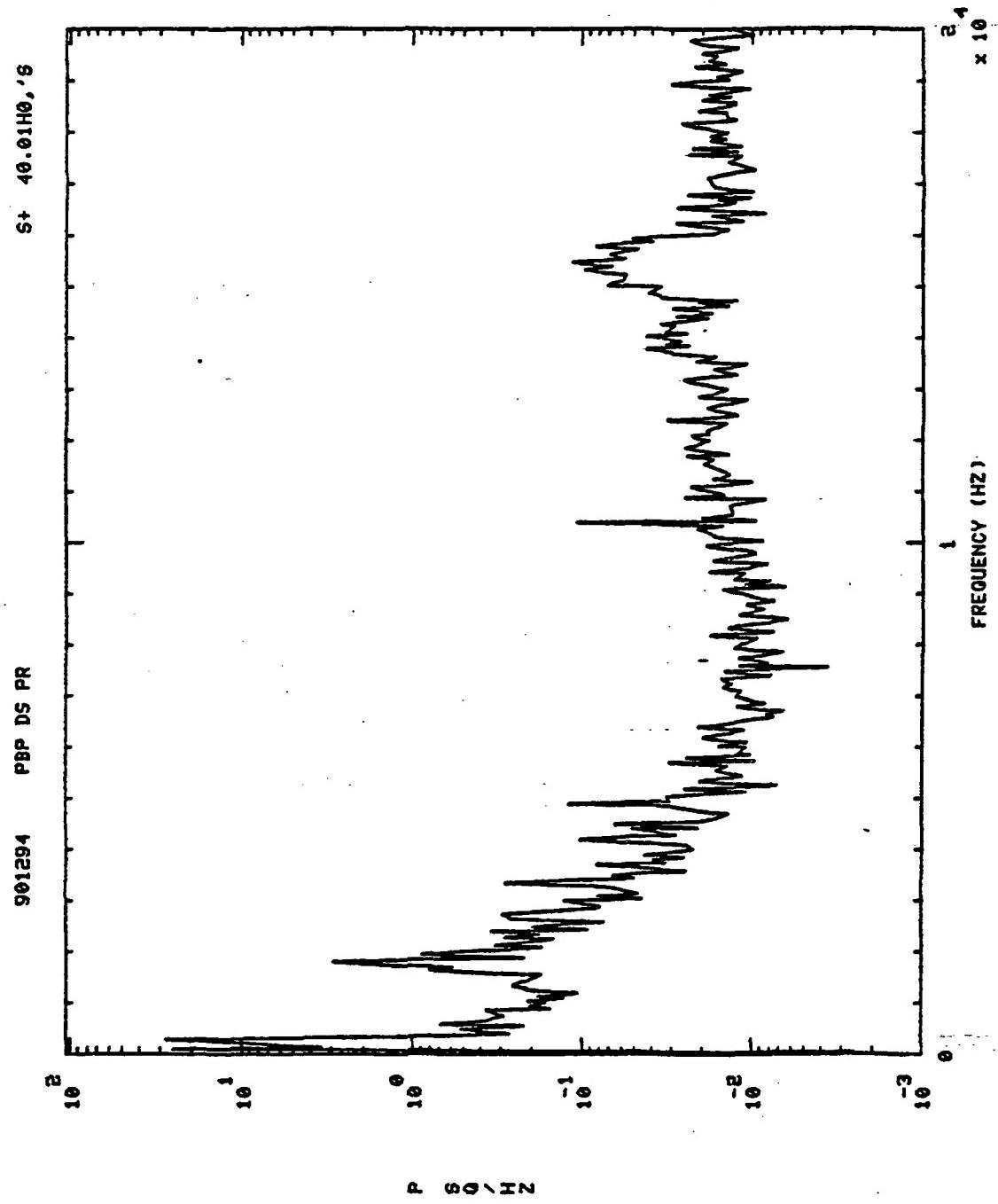


S+ 10.01100 / 5

901294 PBP DS PR



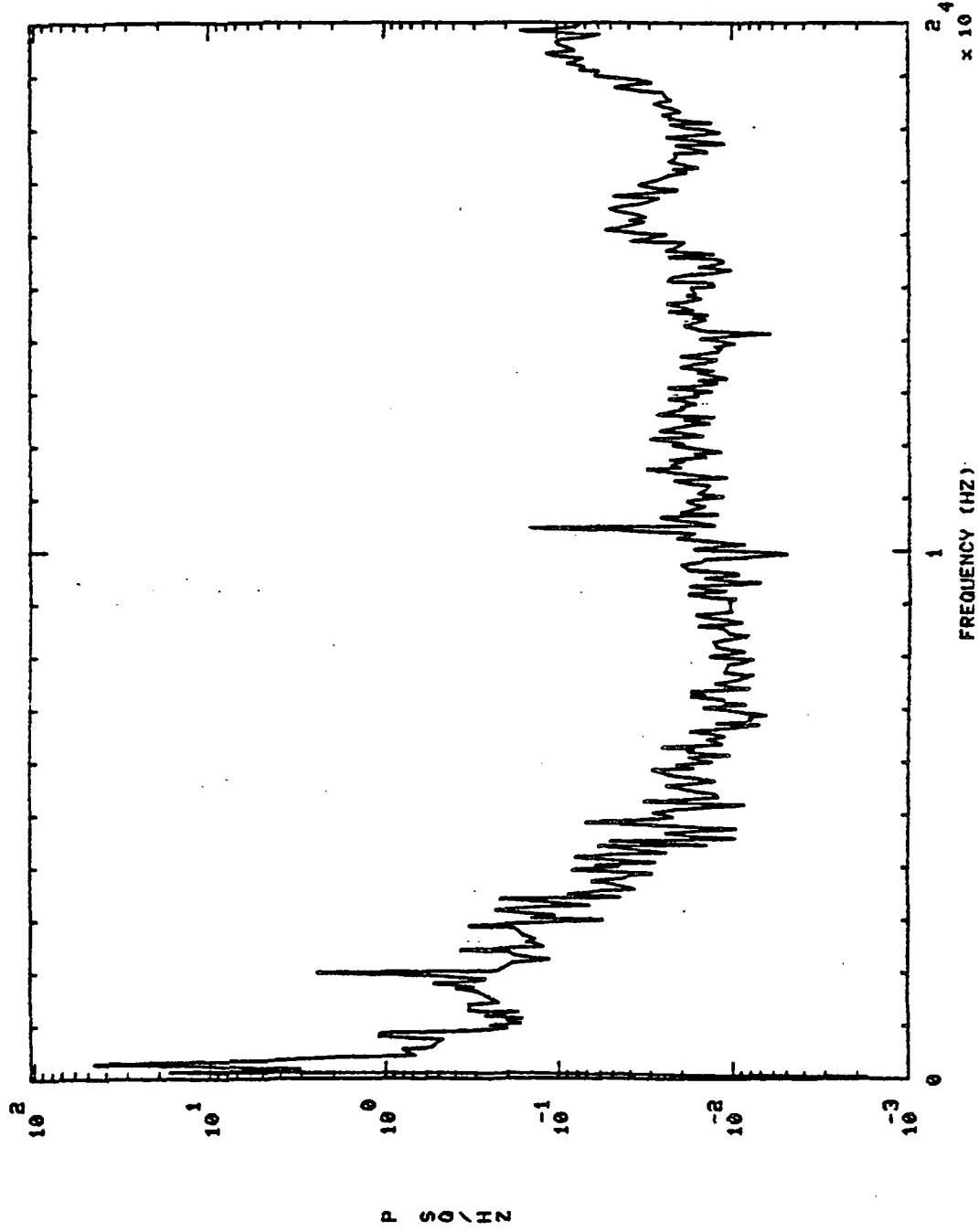
P S 0.1Hz



S+ 100.01H0, 'S

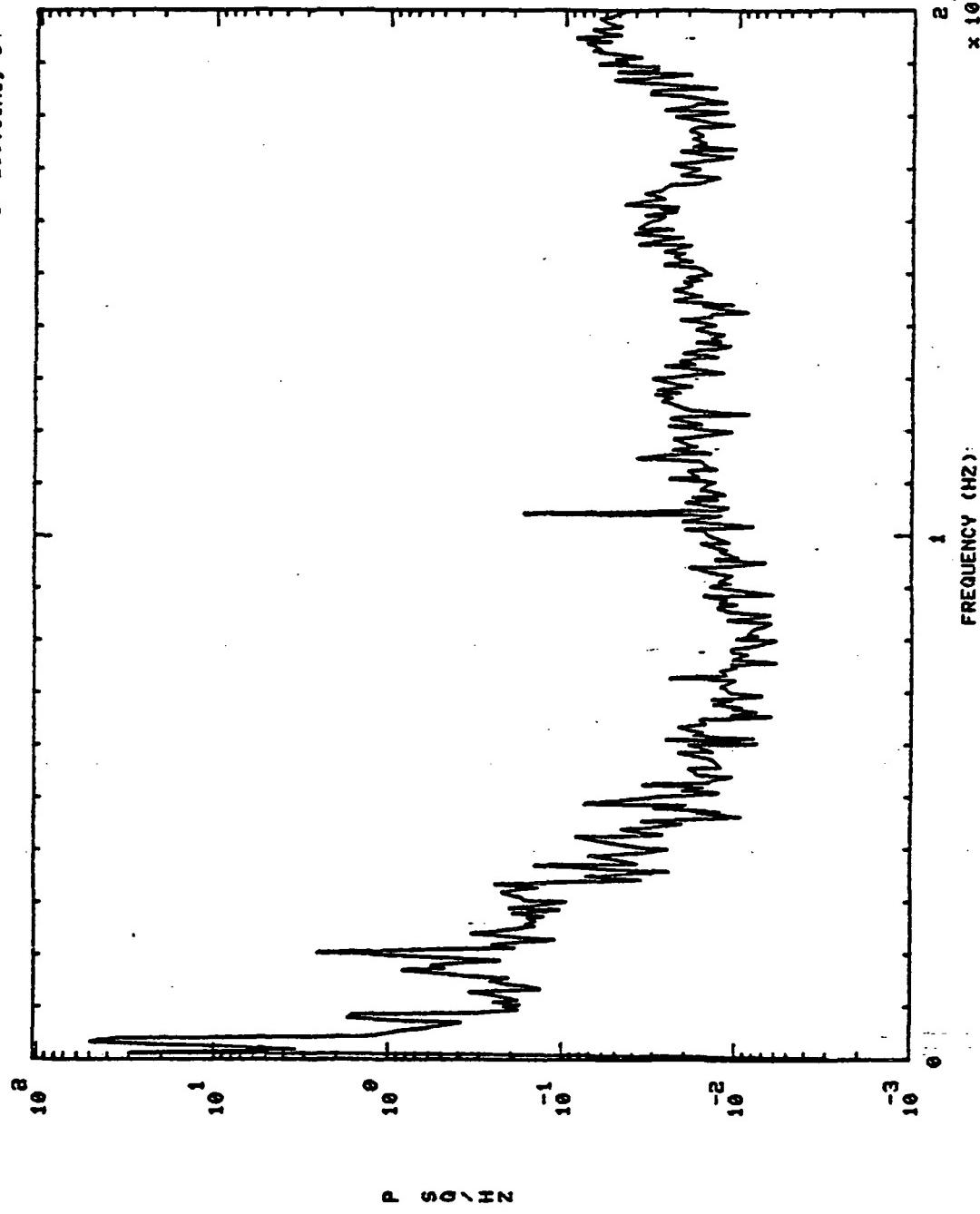
PBP DS PR

961294



801254 PBP DS PR

5+ 300.01Hz./s.



S+ 500.01H0, 'S

PBP DS PR

961294

10²

10¹

10⁰

10⁻¹

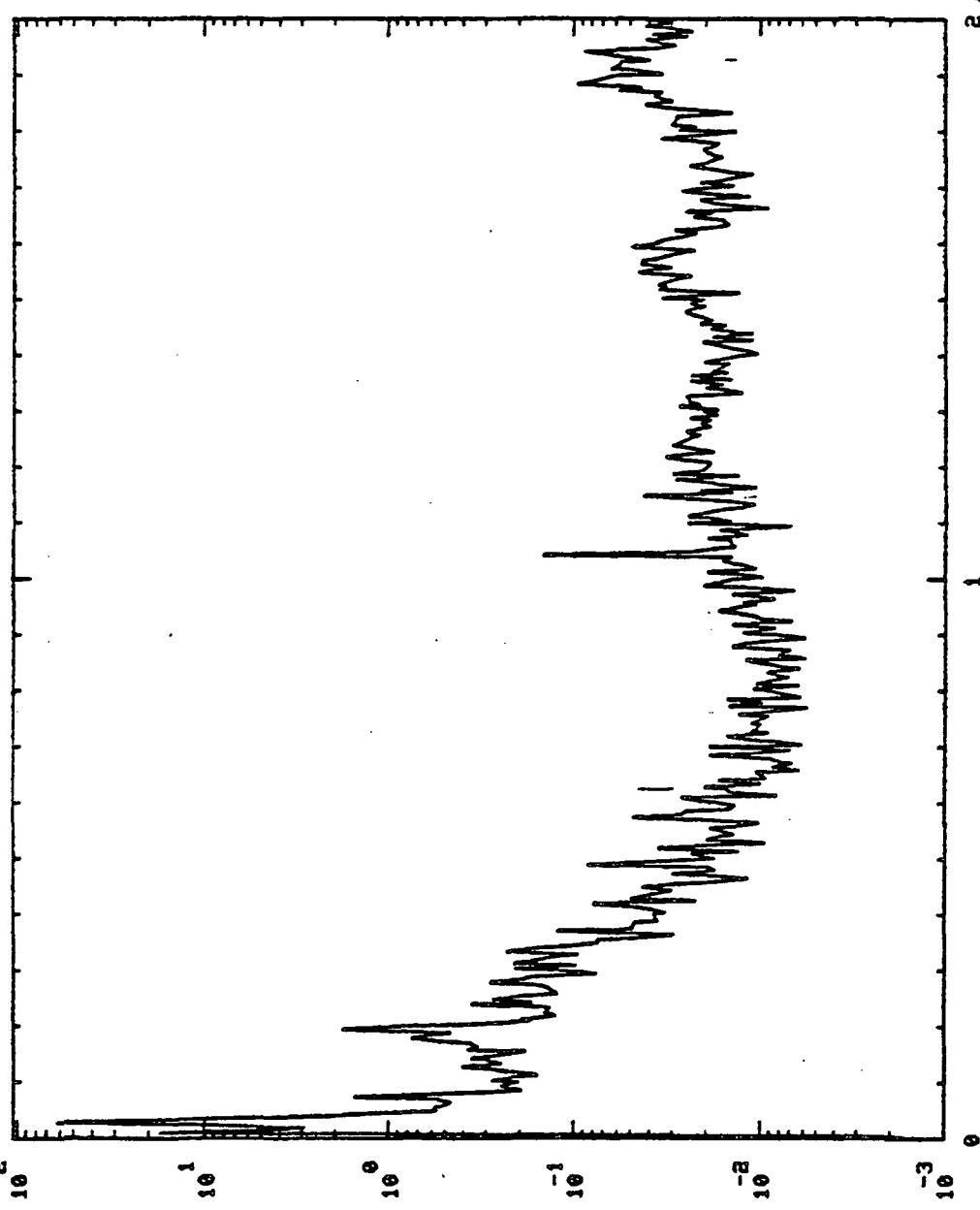
10⁻²

10⁻³

P S G / HZ

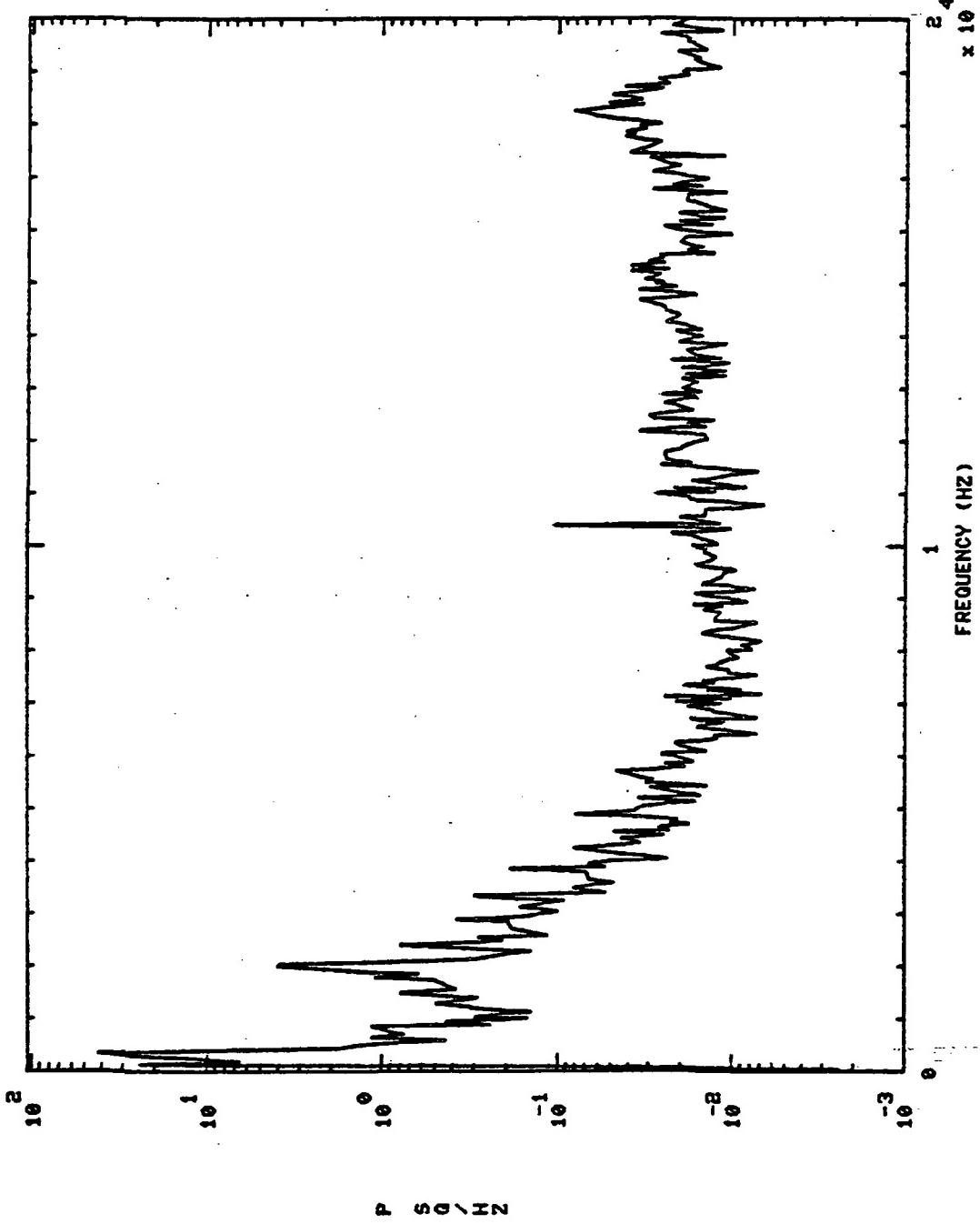
2.4
x 10⁴

1
FREQUENCY (HZ)



901294 PBP DS PR

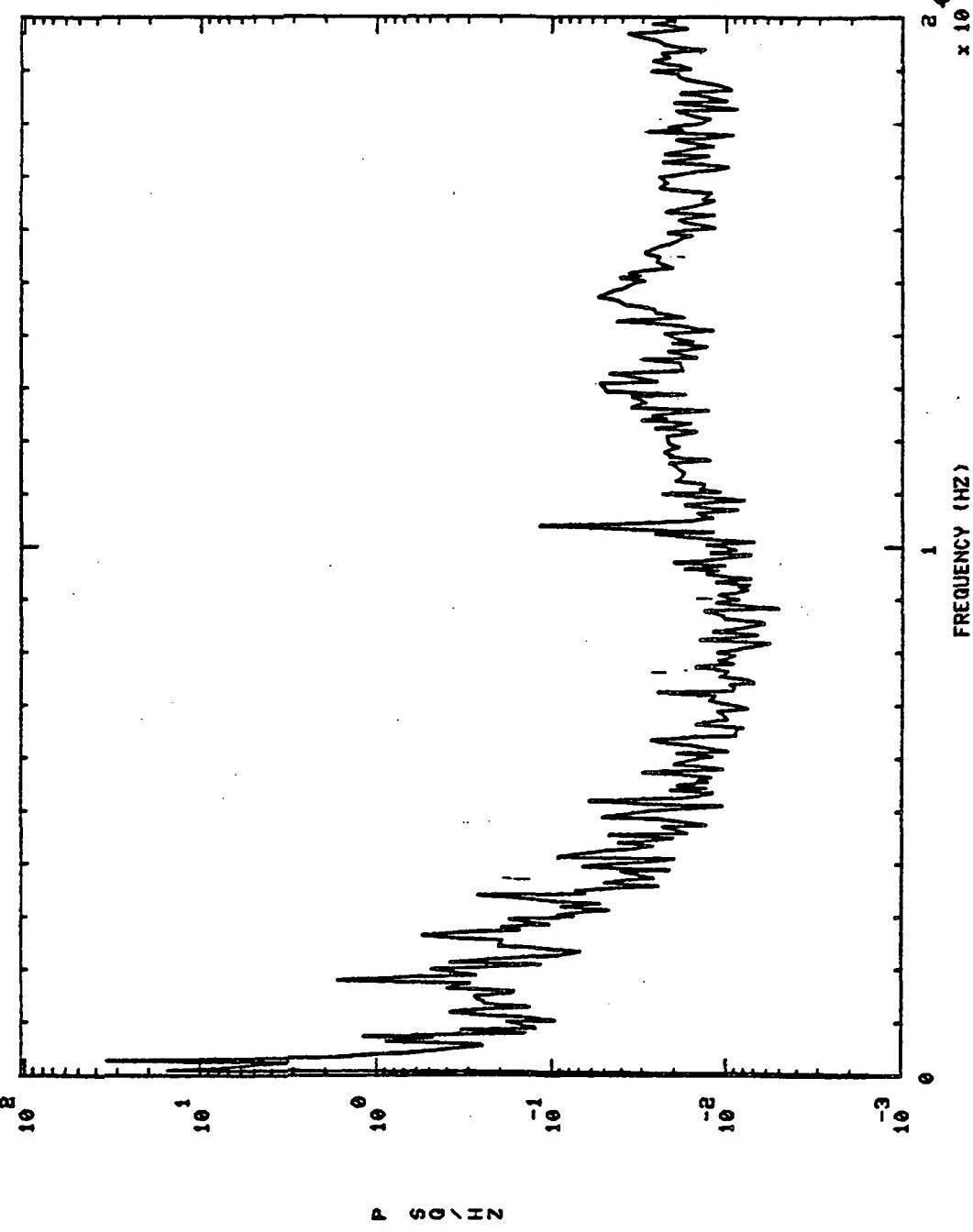
S+ 645.01H0.'6

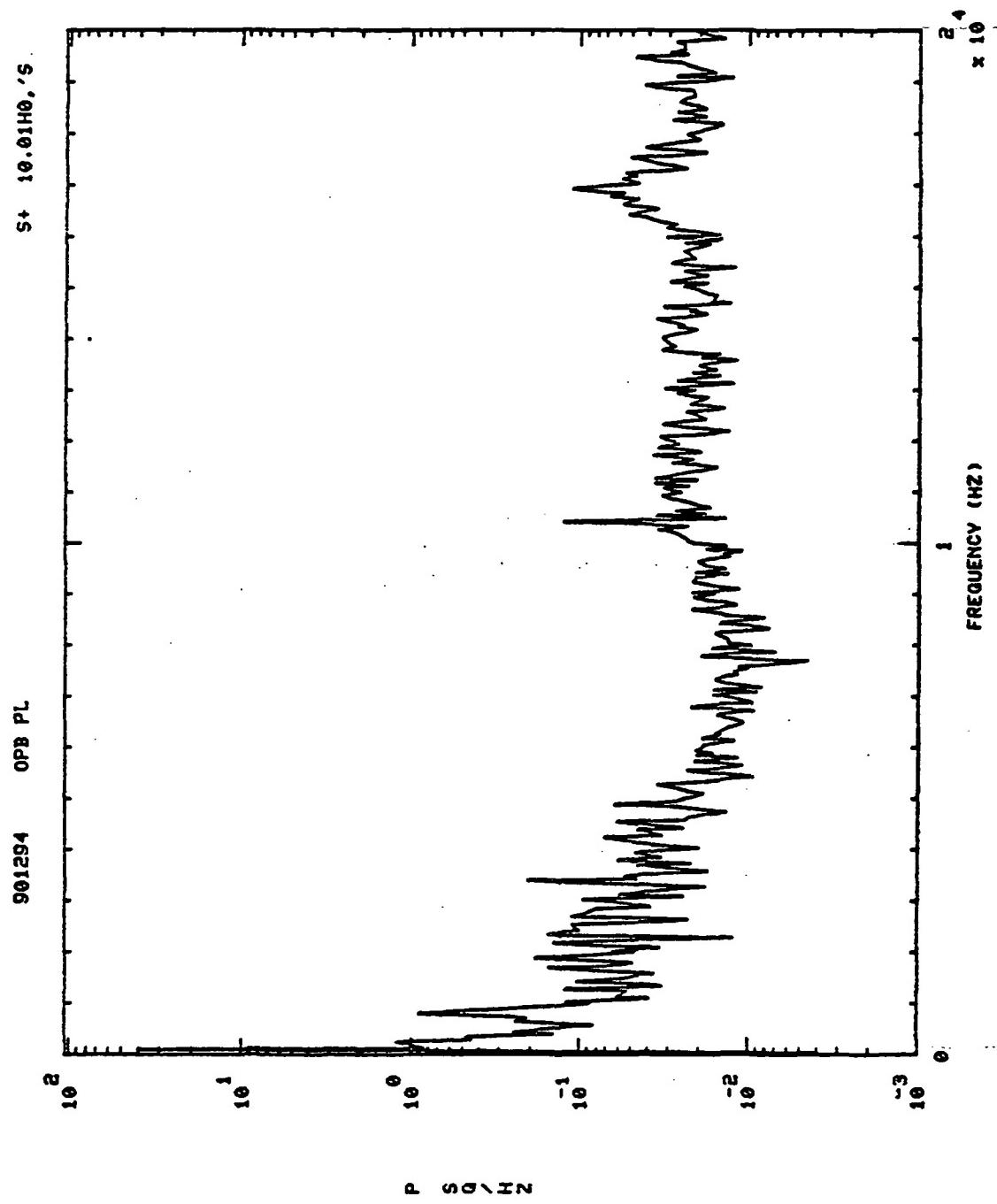


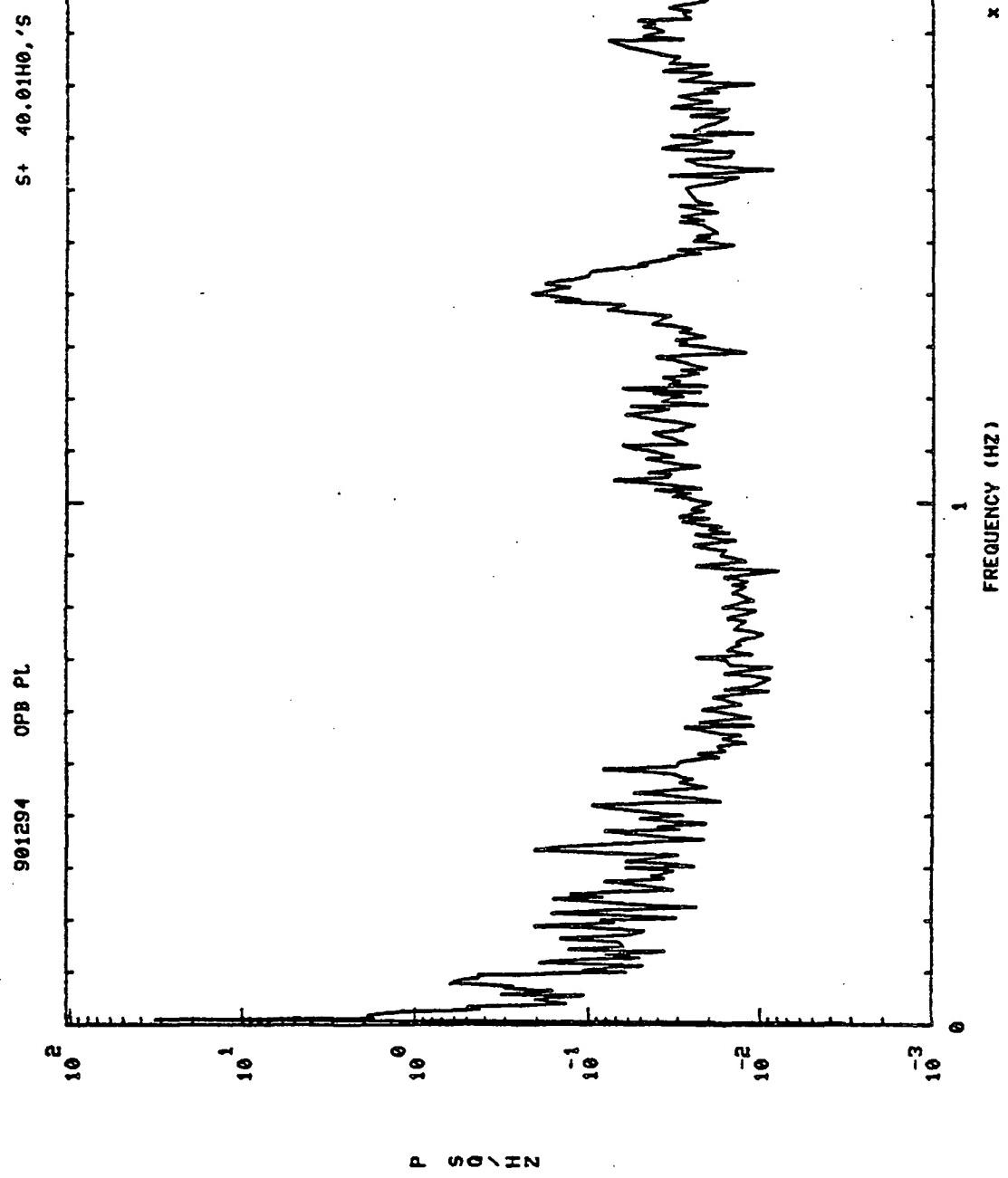
S+ 660.01H0, '5

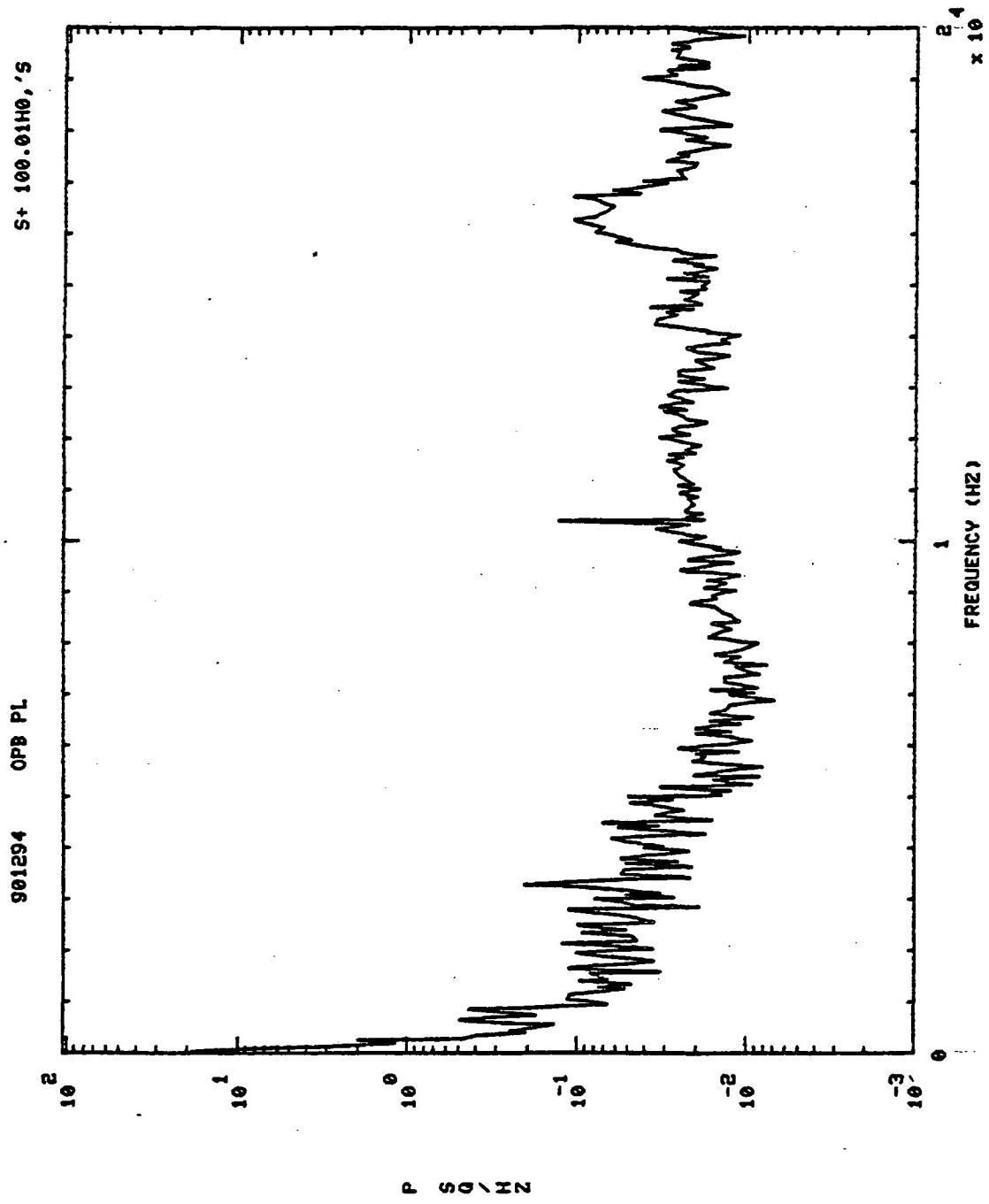
PBP DS PR

901294



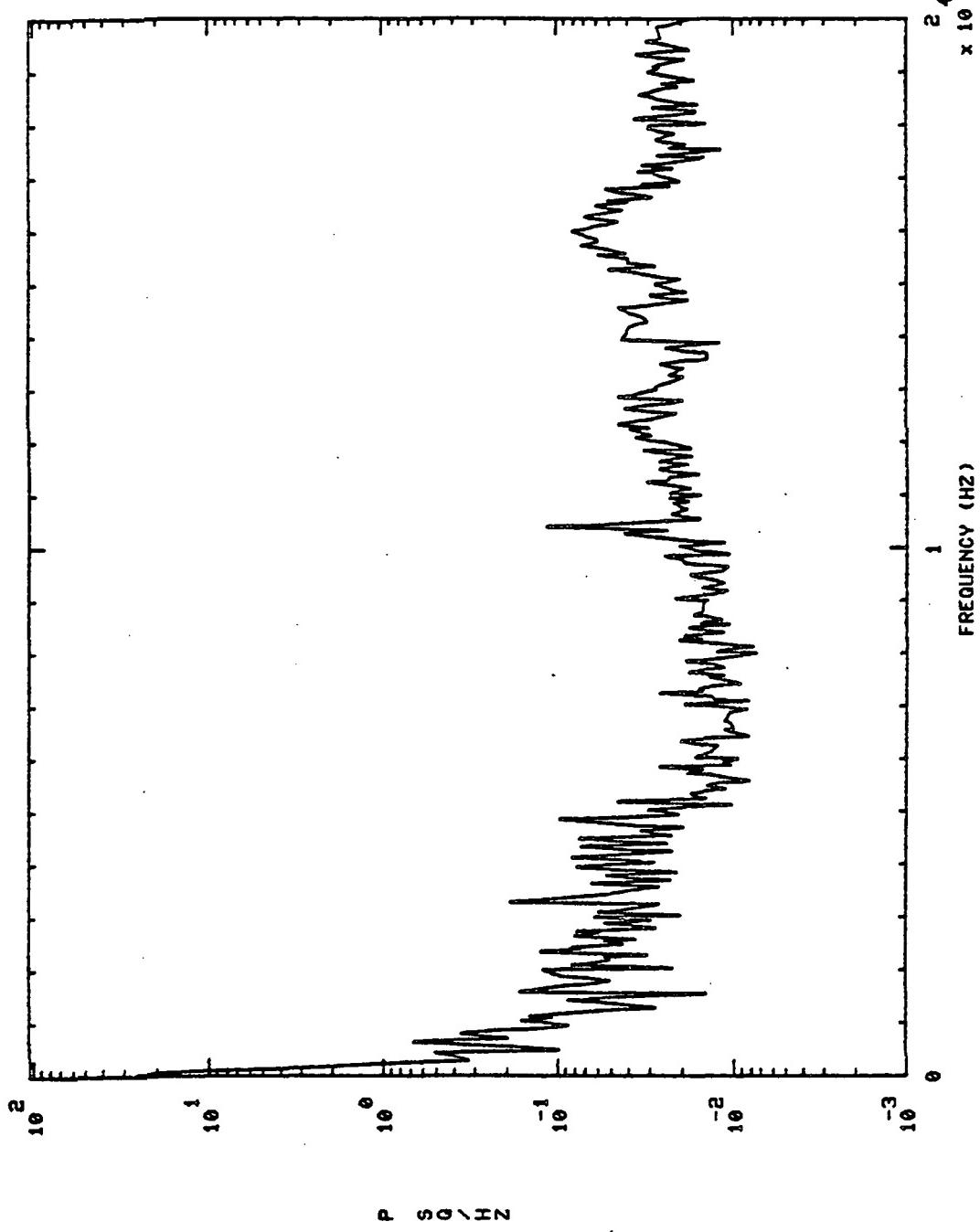


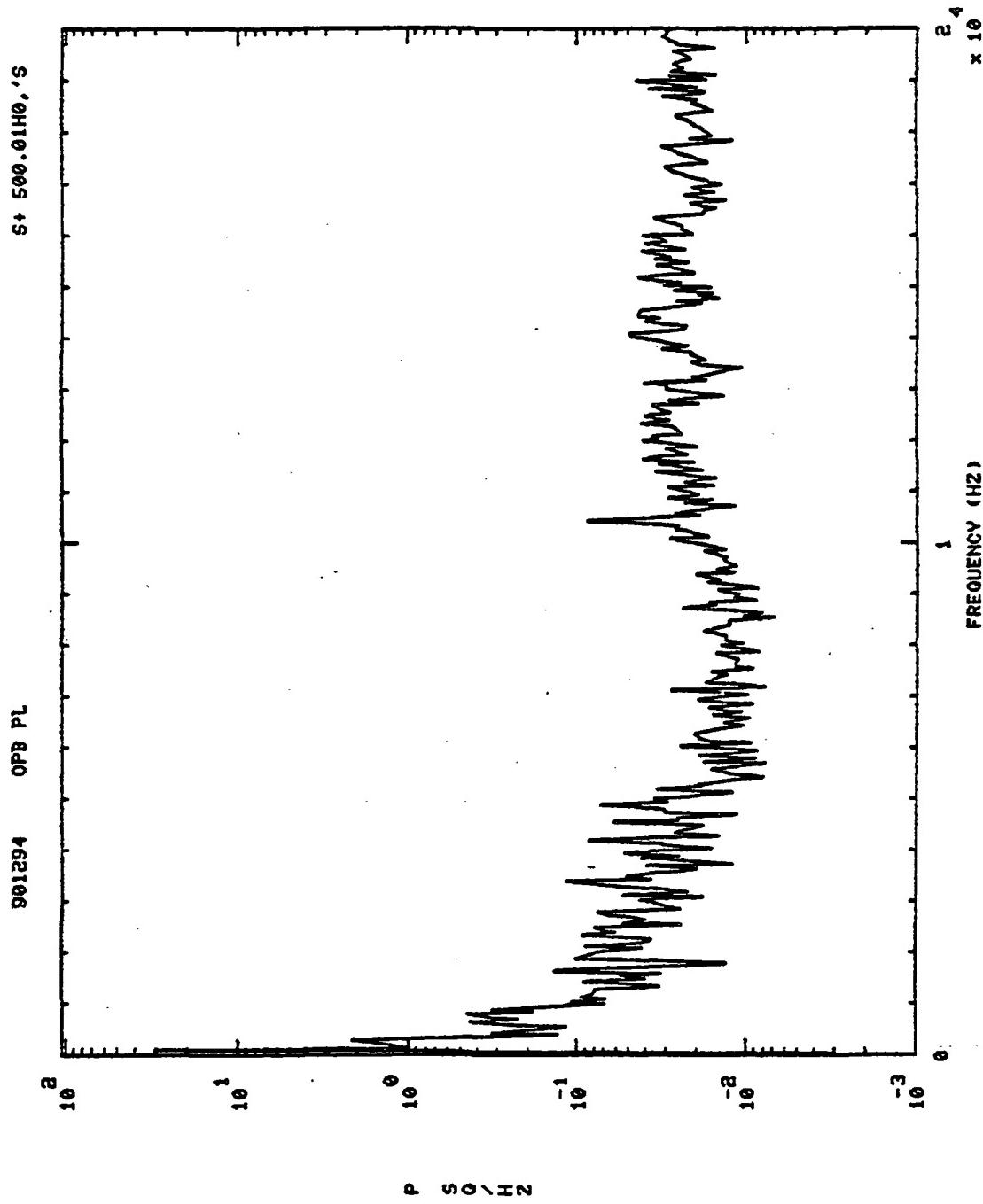




S+ 300.01H0.'S

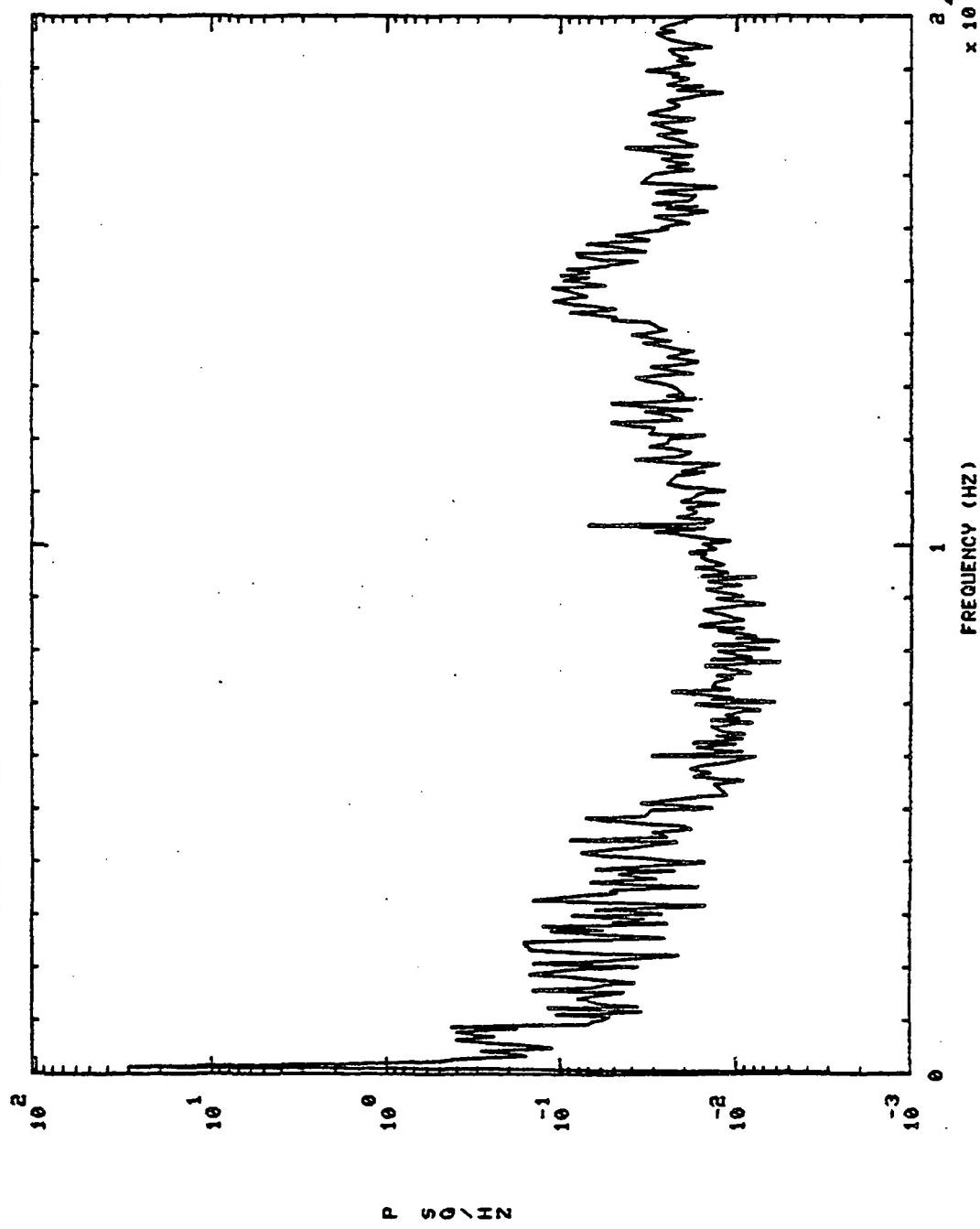
901294 OPB PL

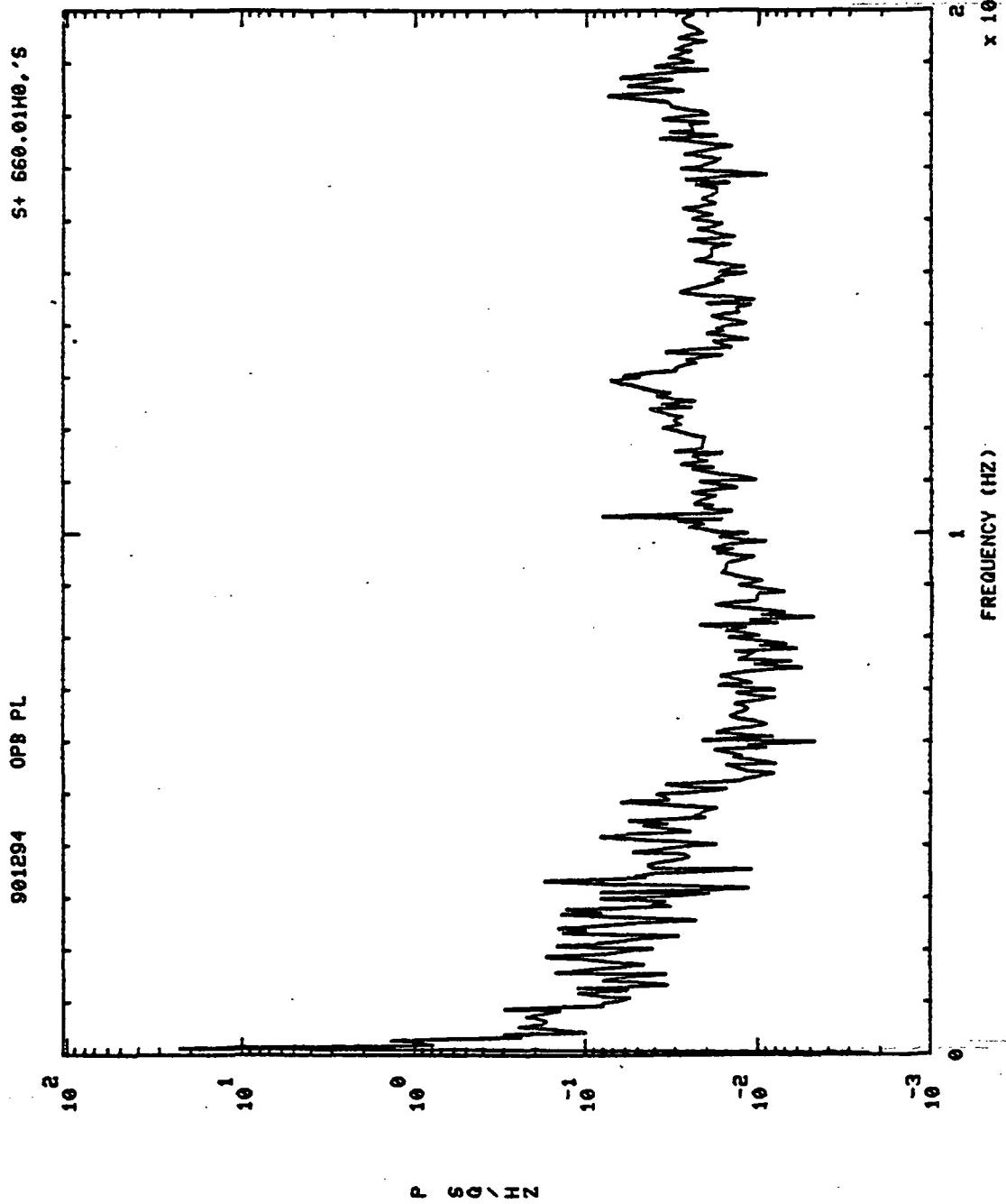




S+ 645.01H0, 'S

901294 OPB PL

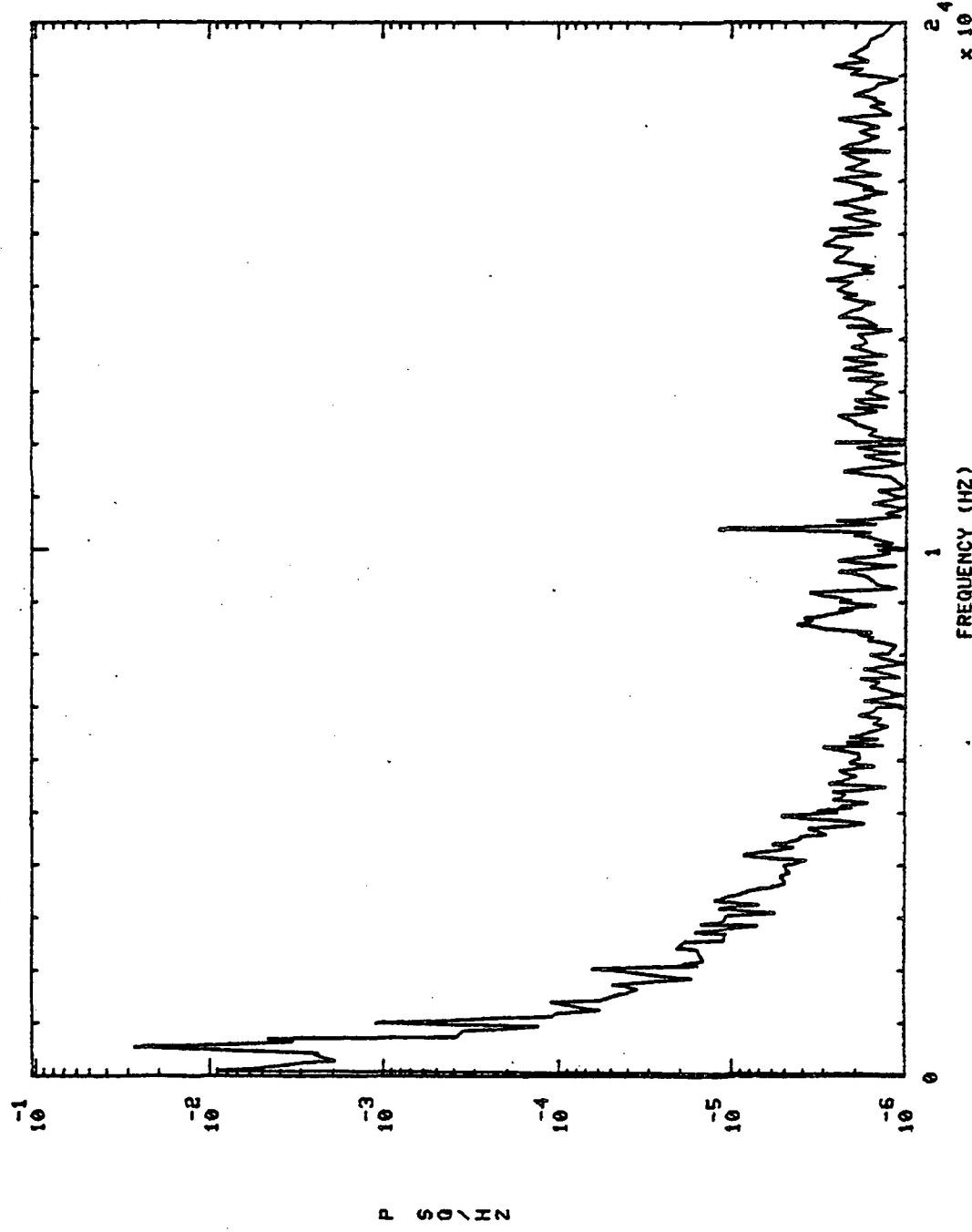


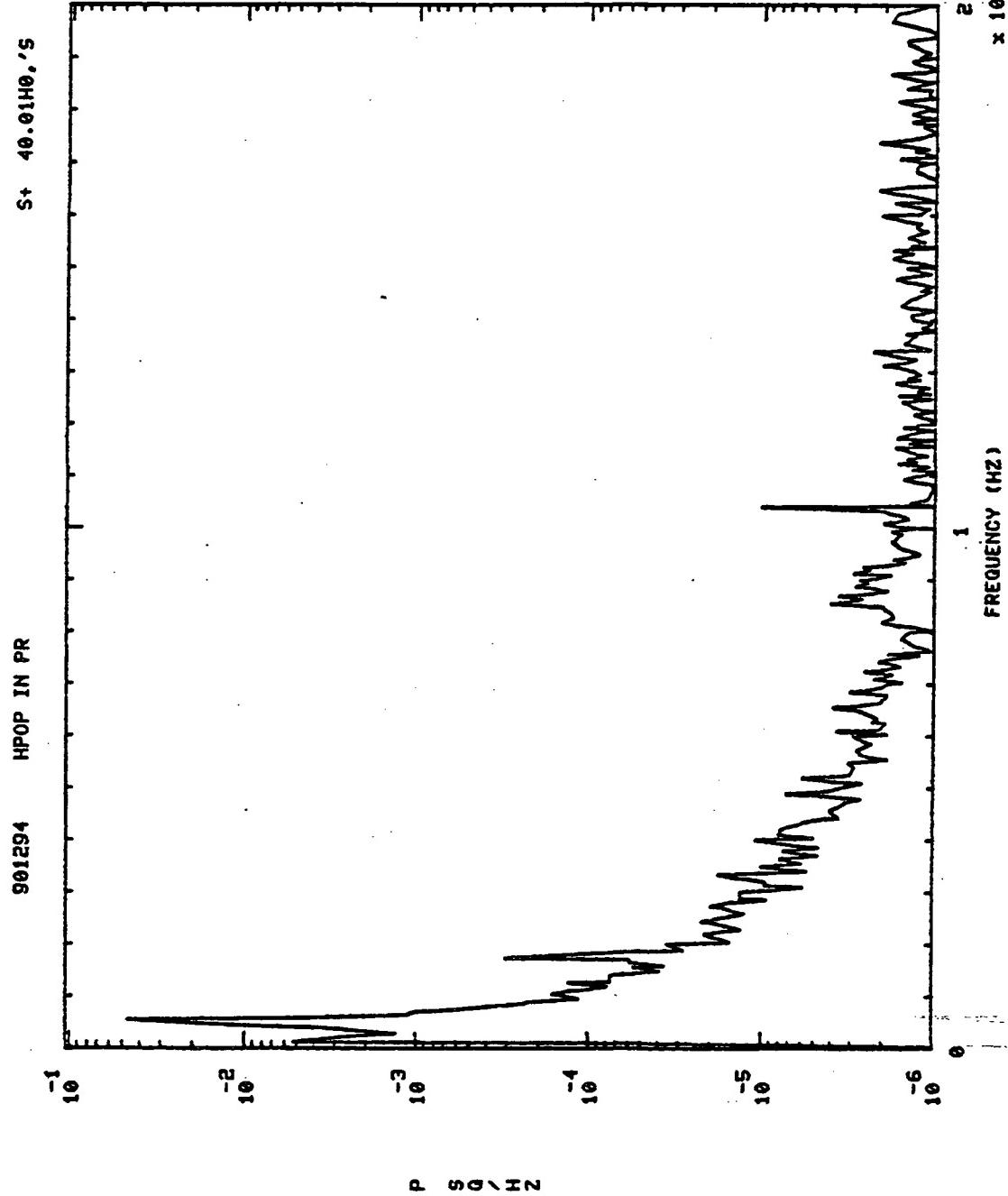


901294

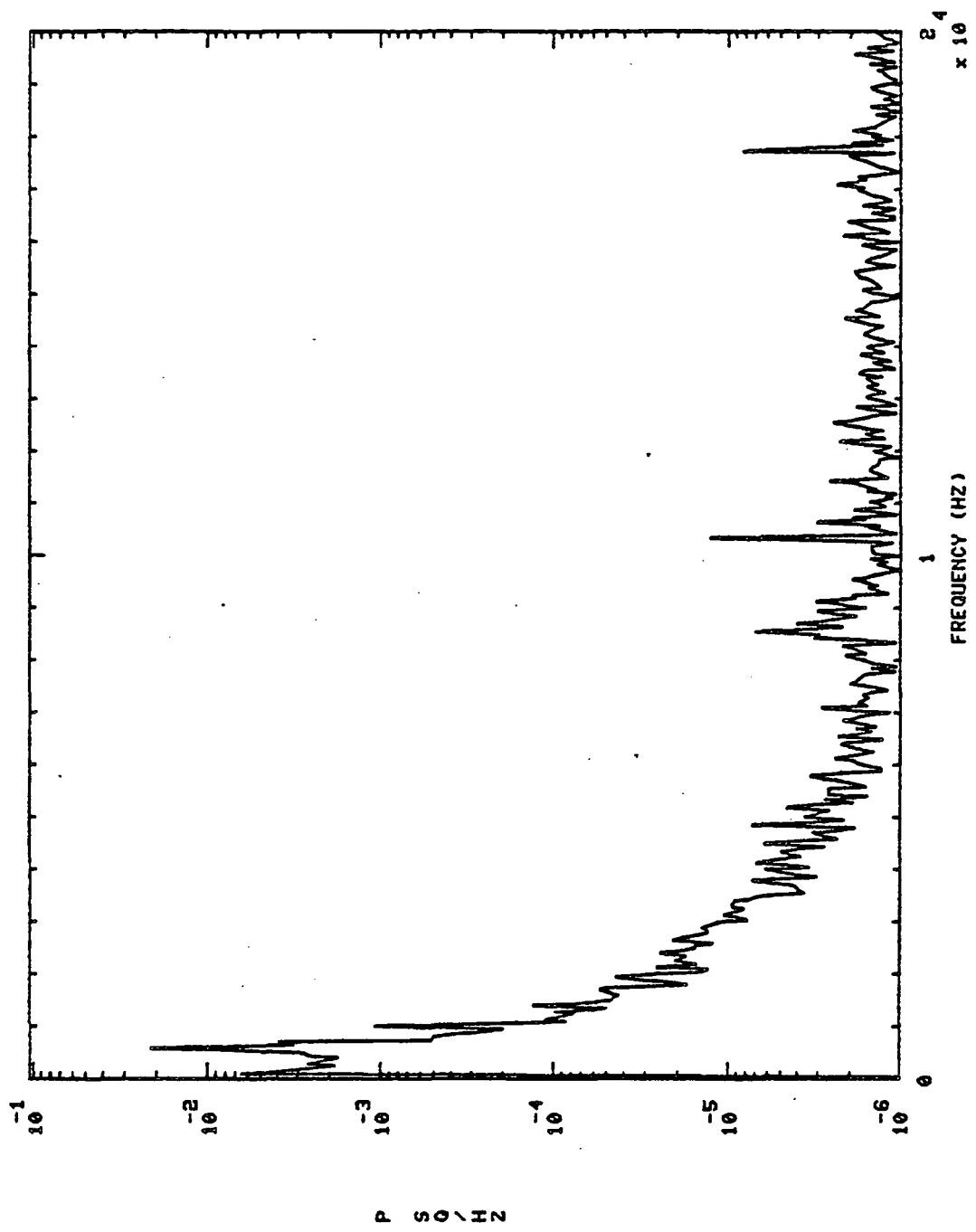
HPOP IN PR

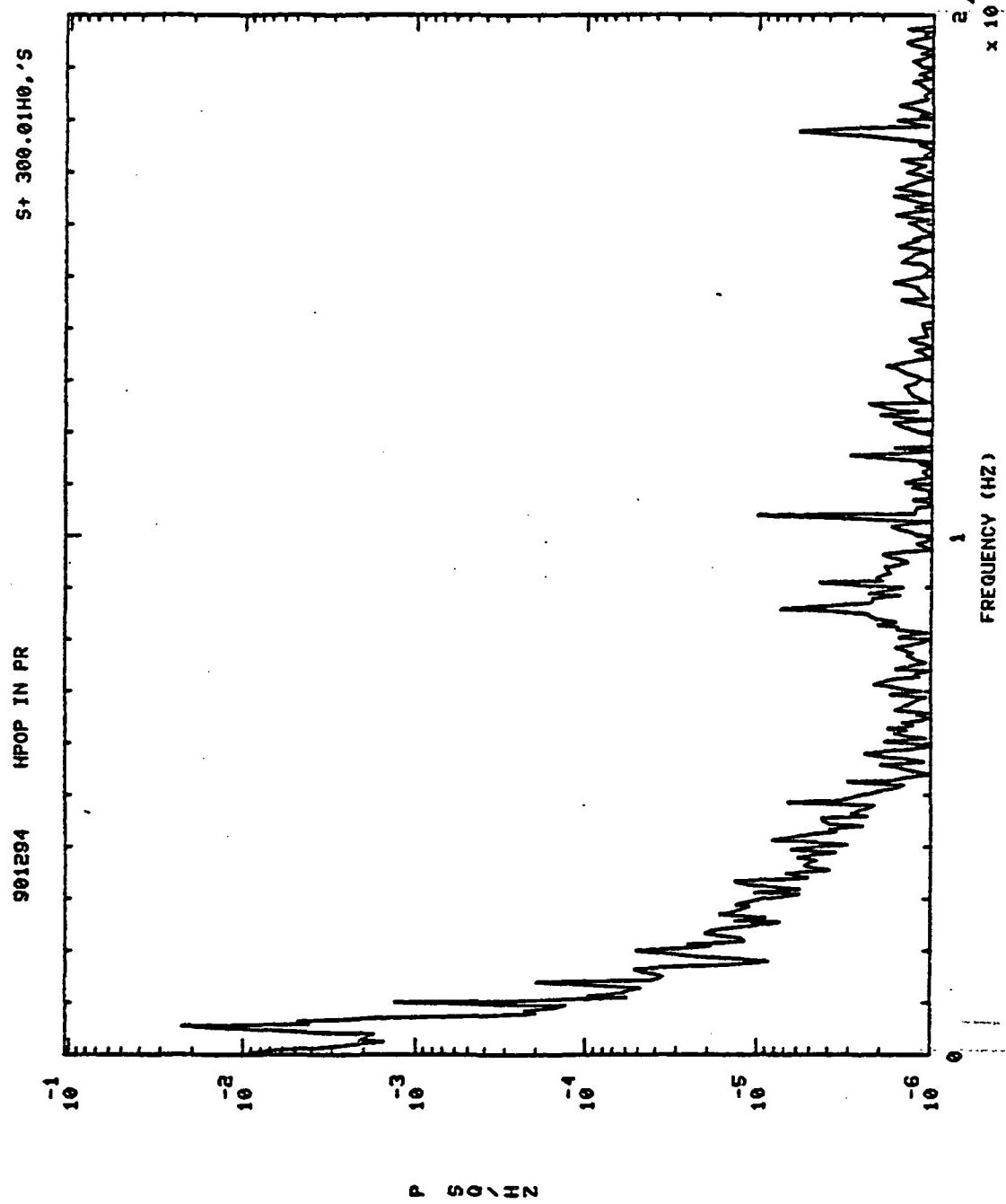
S + 10.01Hz, 'S



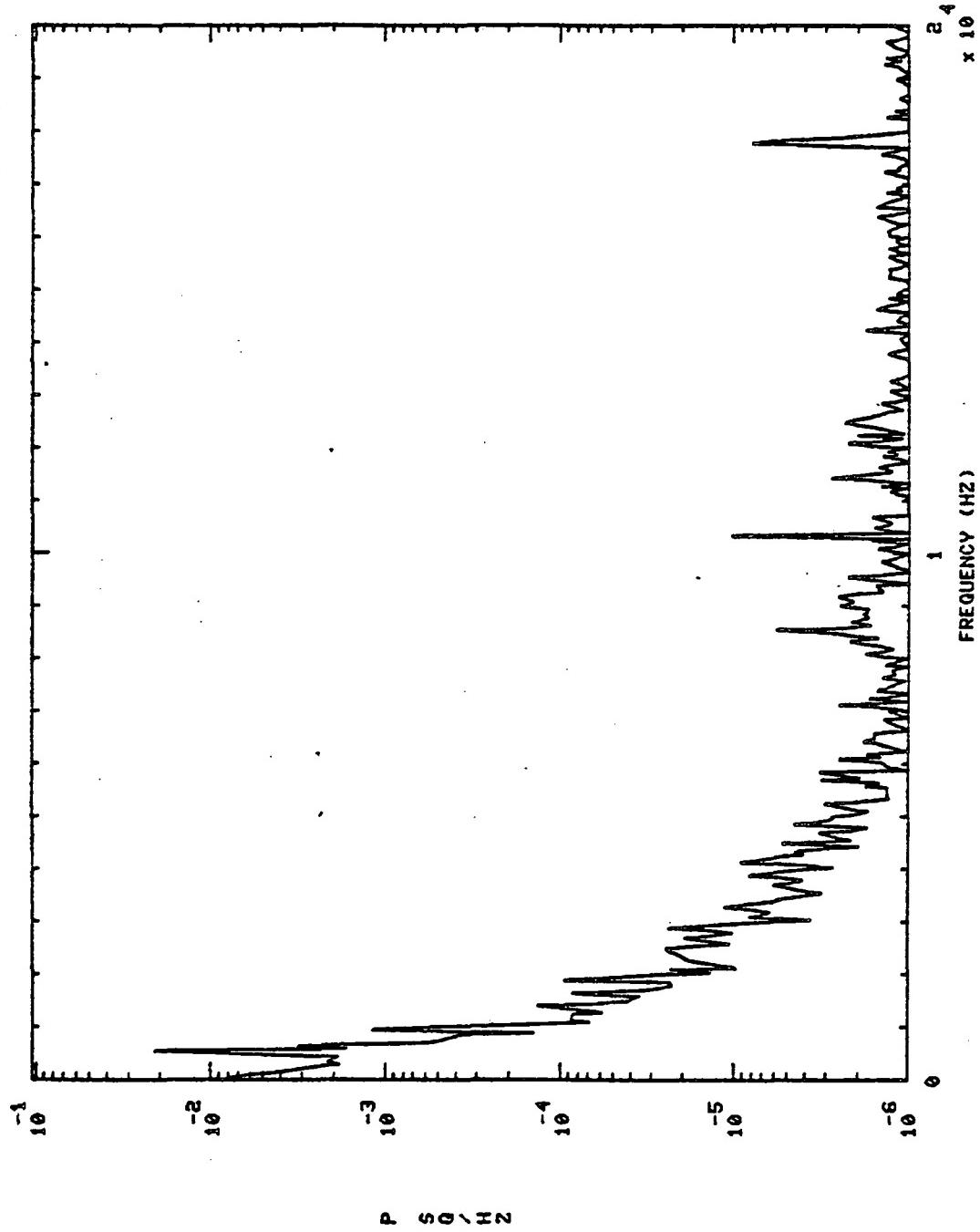


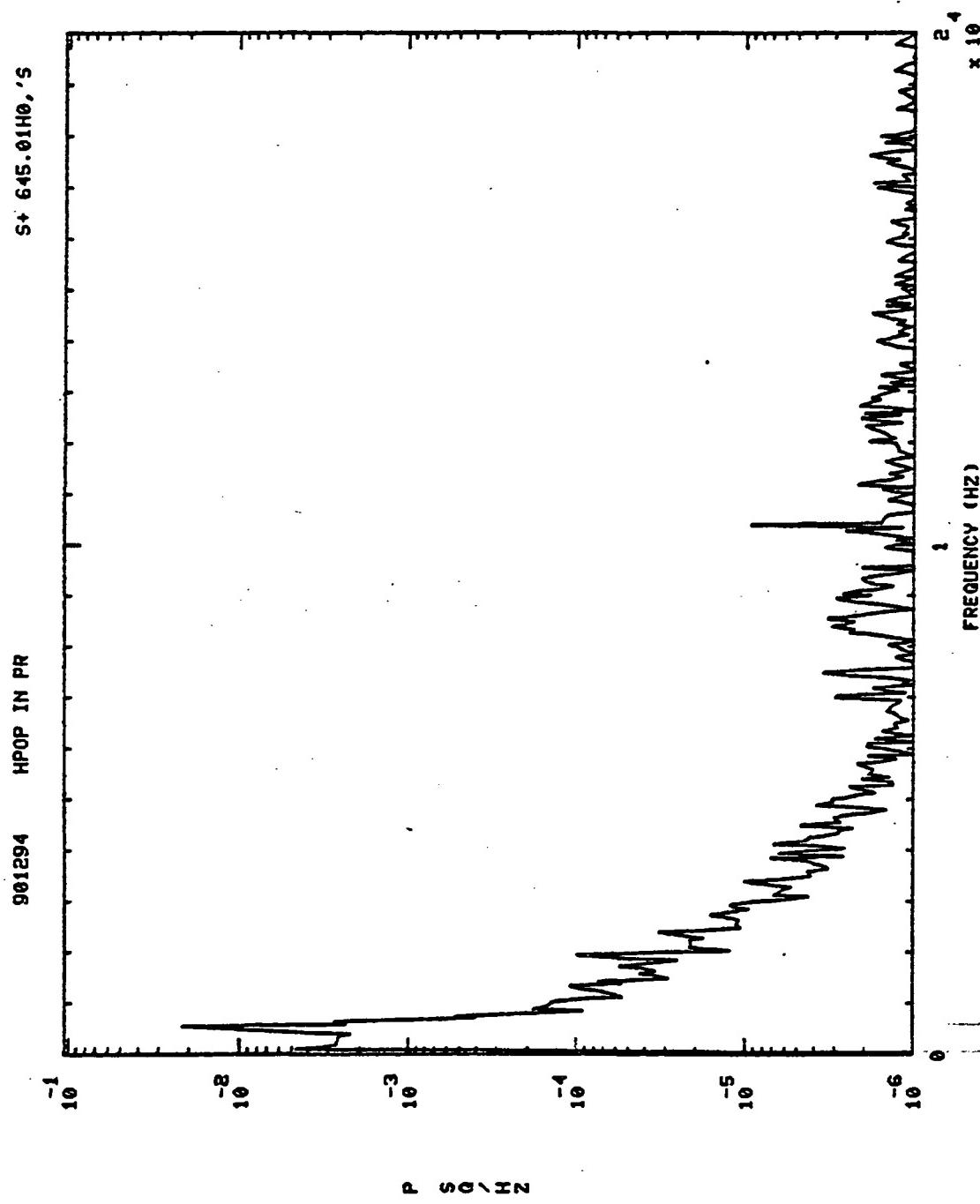
901294 HPOP IN PR S + 100.0140, 'S





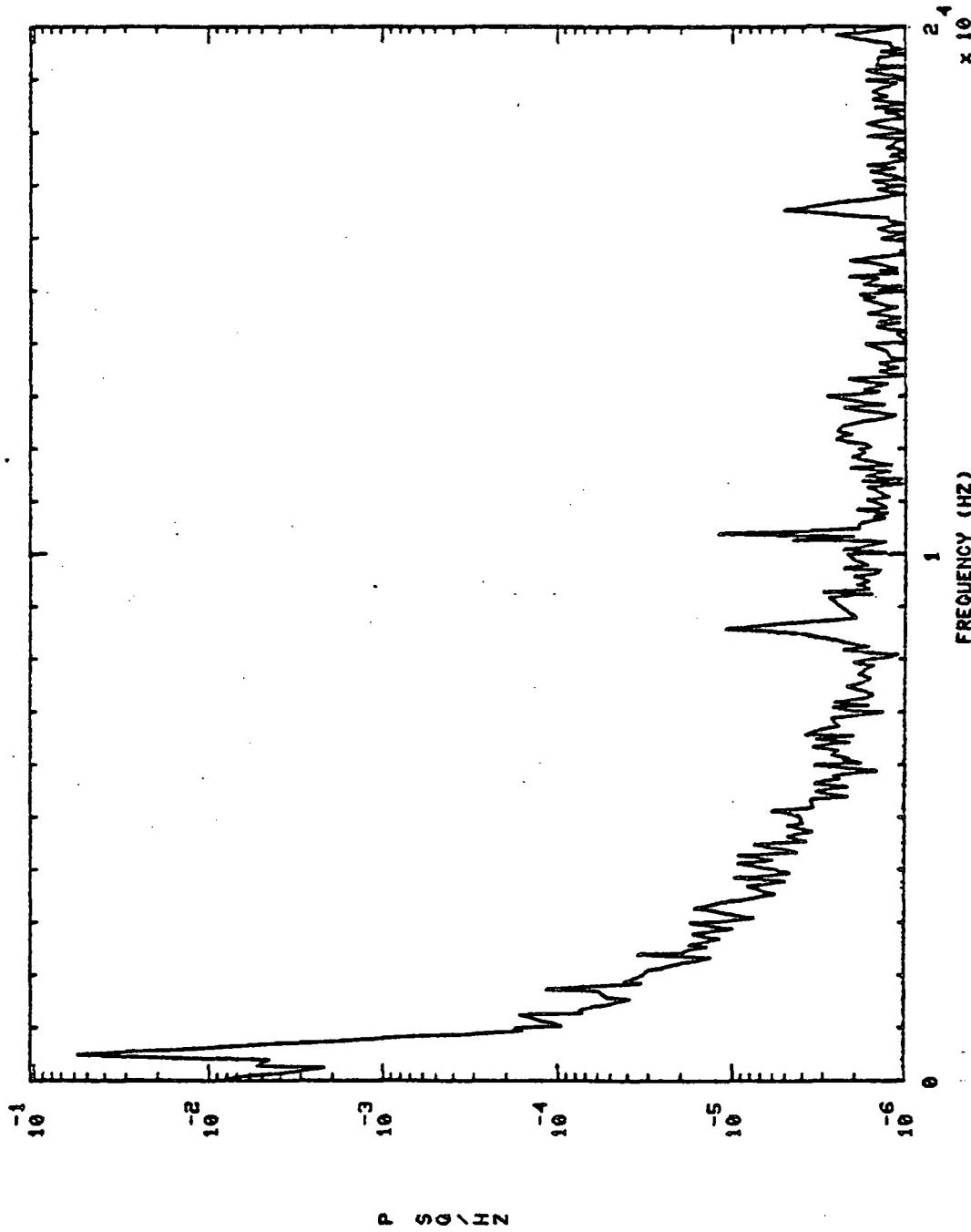
901294 HPOP IN PR S+ 500.01Hz, 'S

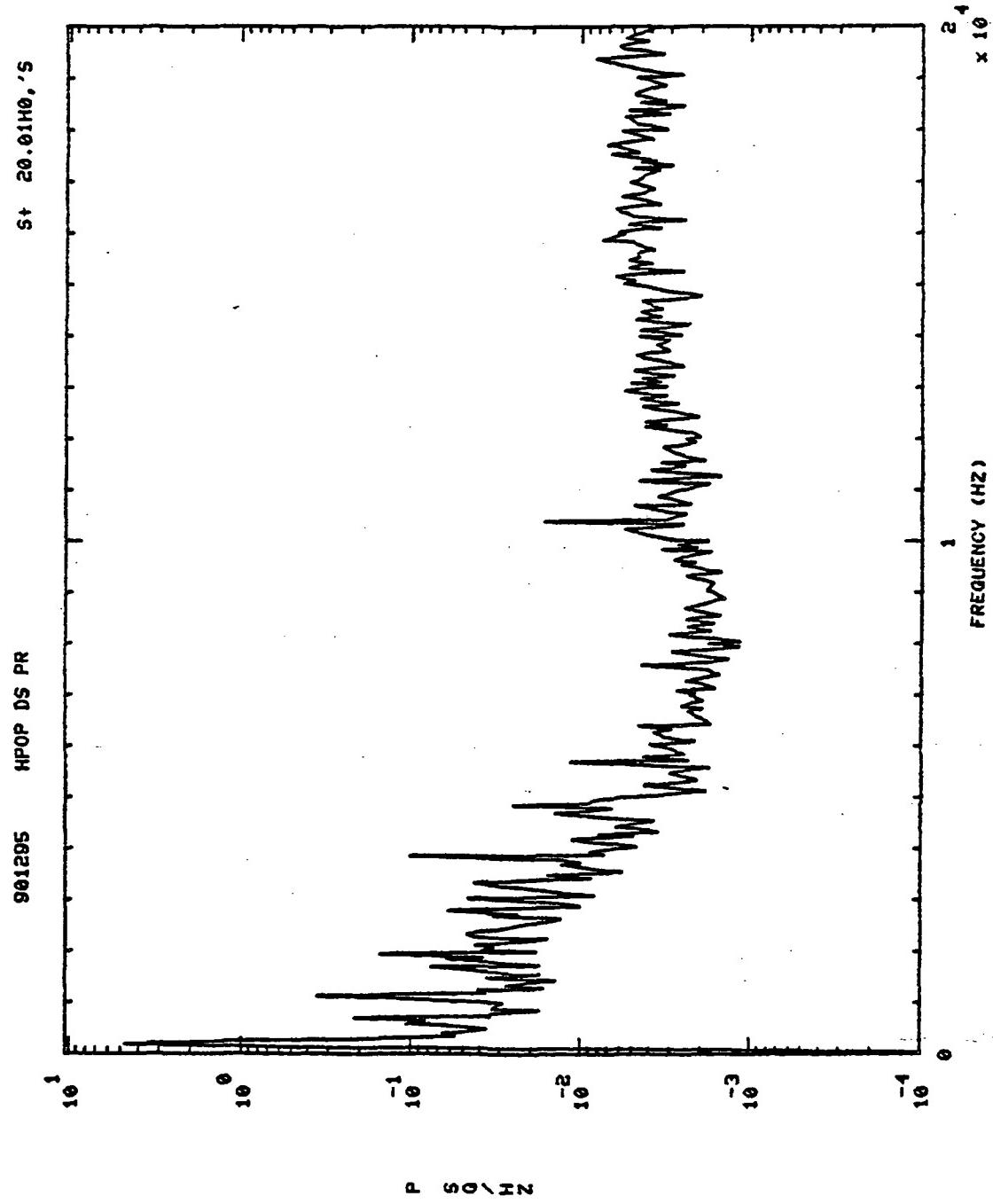




S+ 660.01H0, 'S

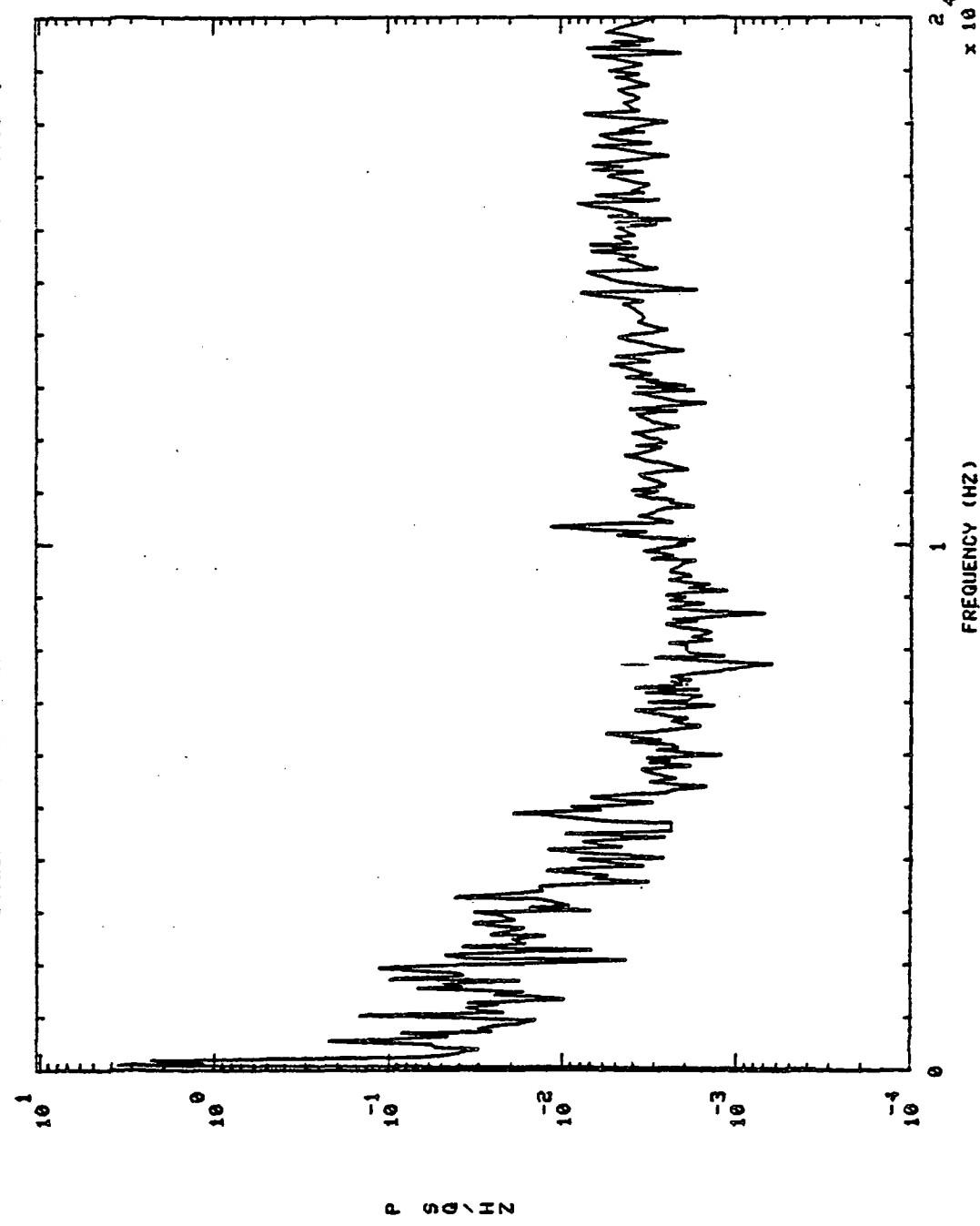
HPGP IN PR
901294

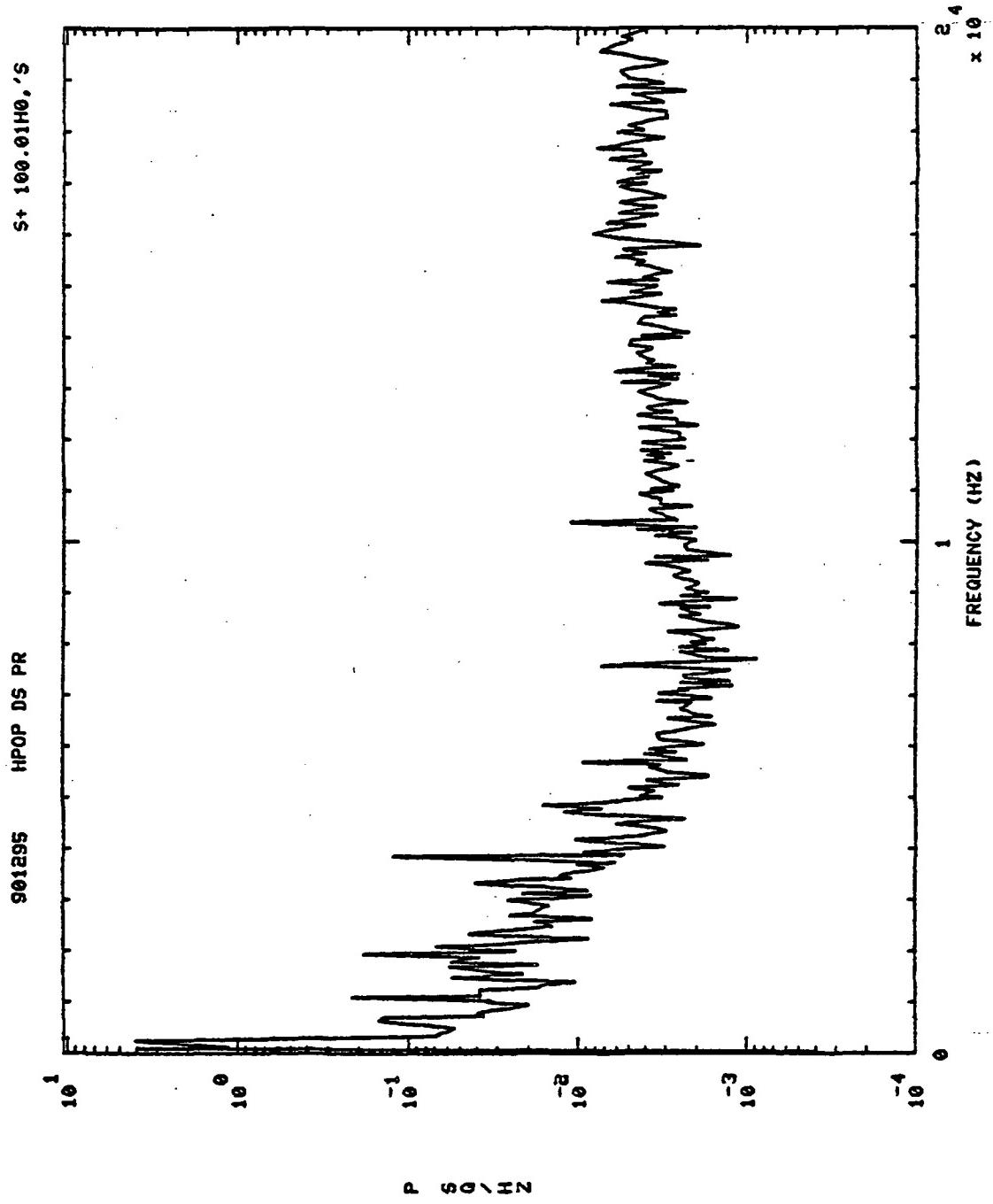




S+ 45.01H0,5

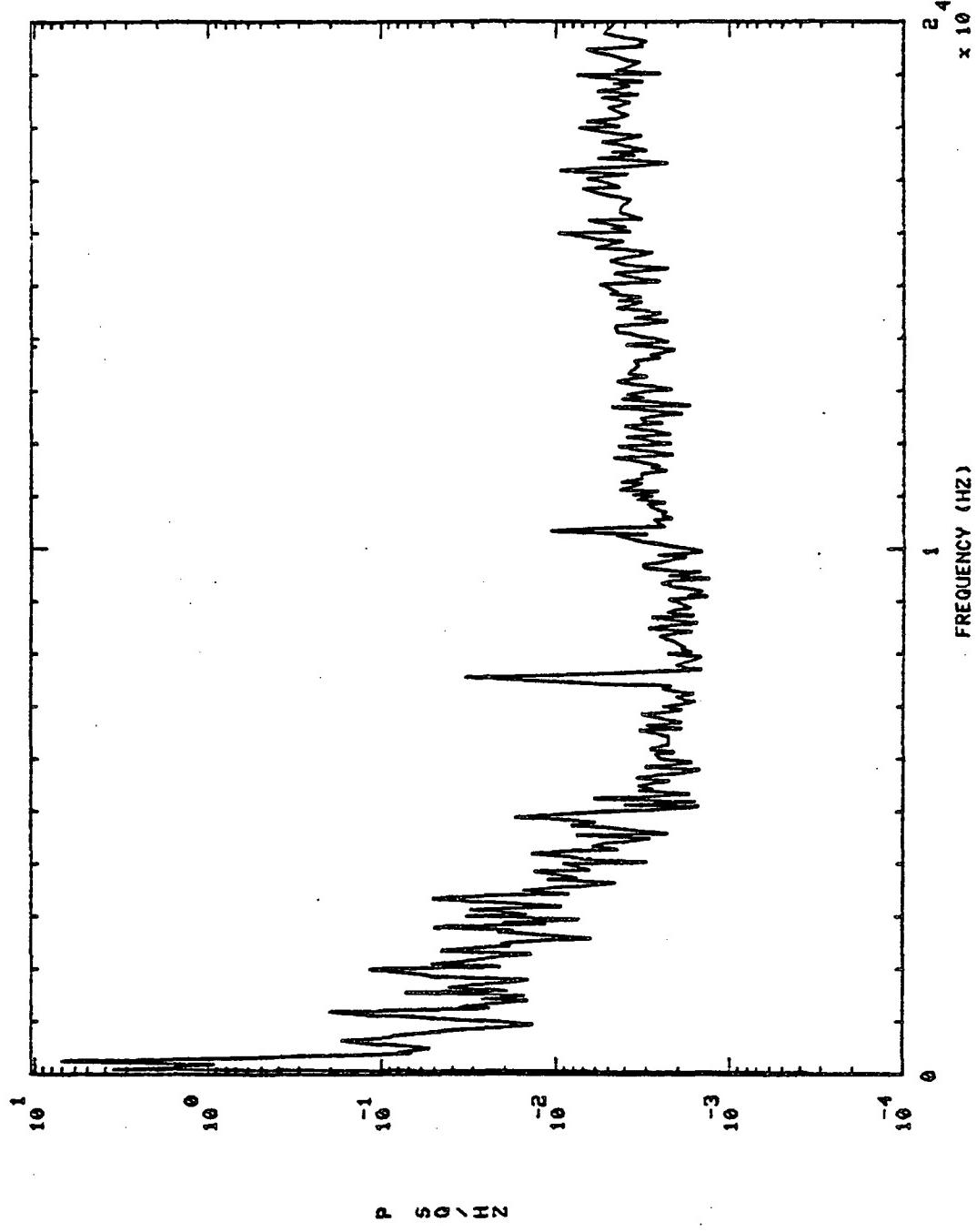
901295 HPOP DS PR

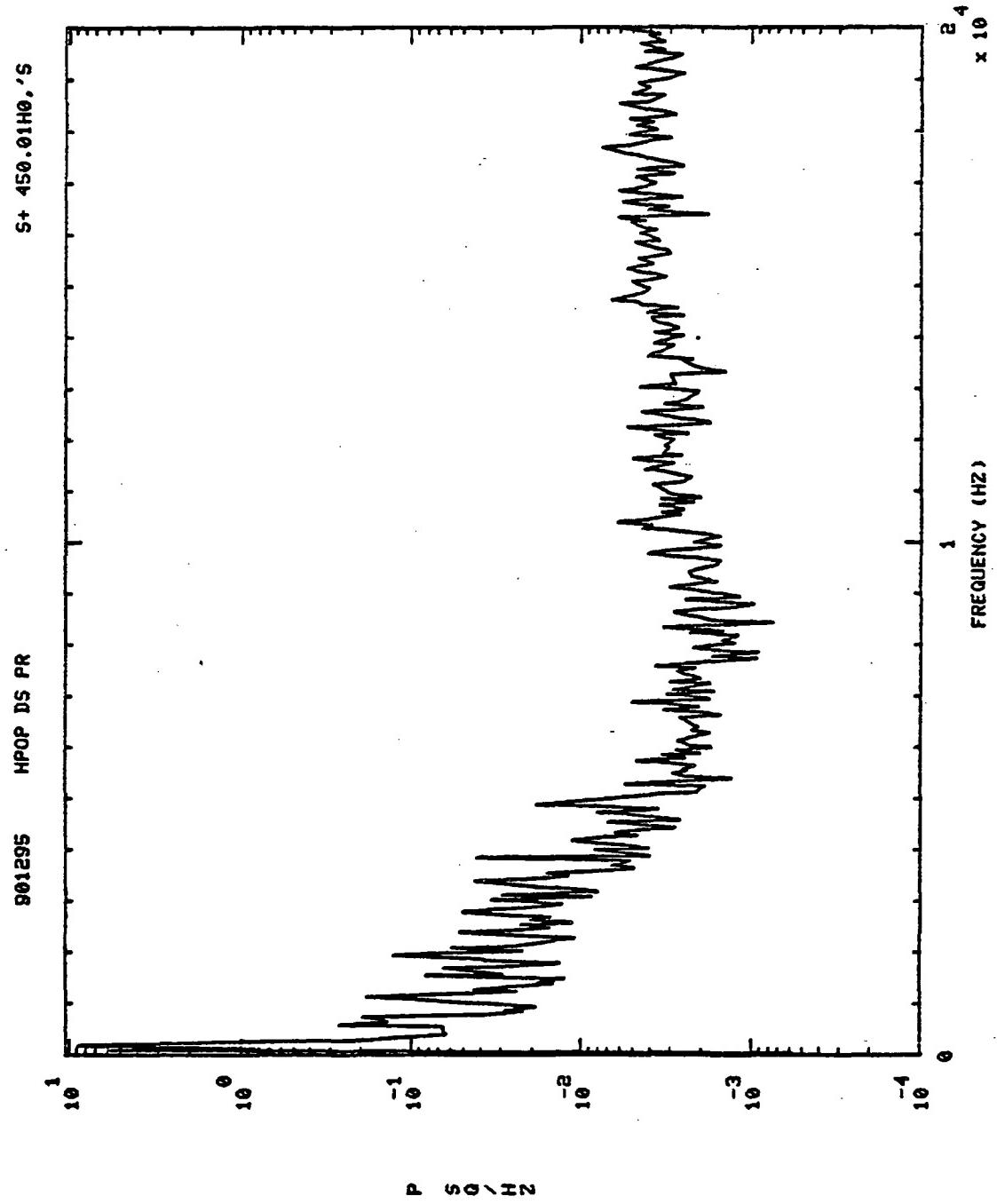




St 300.01H0.'S

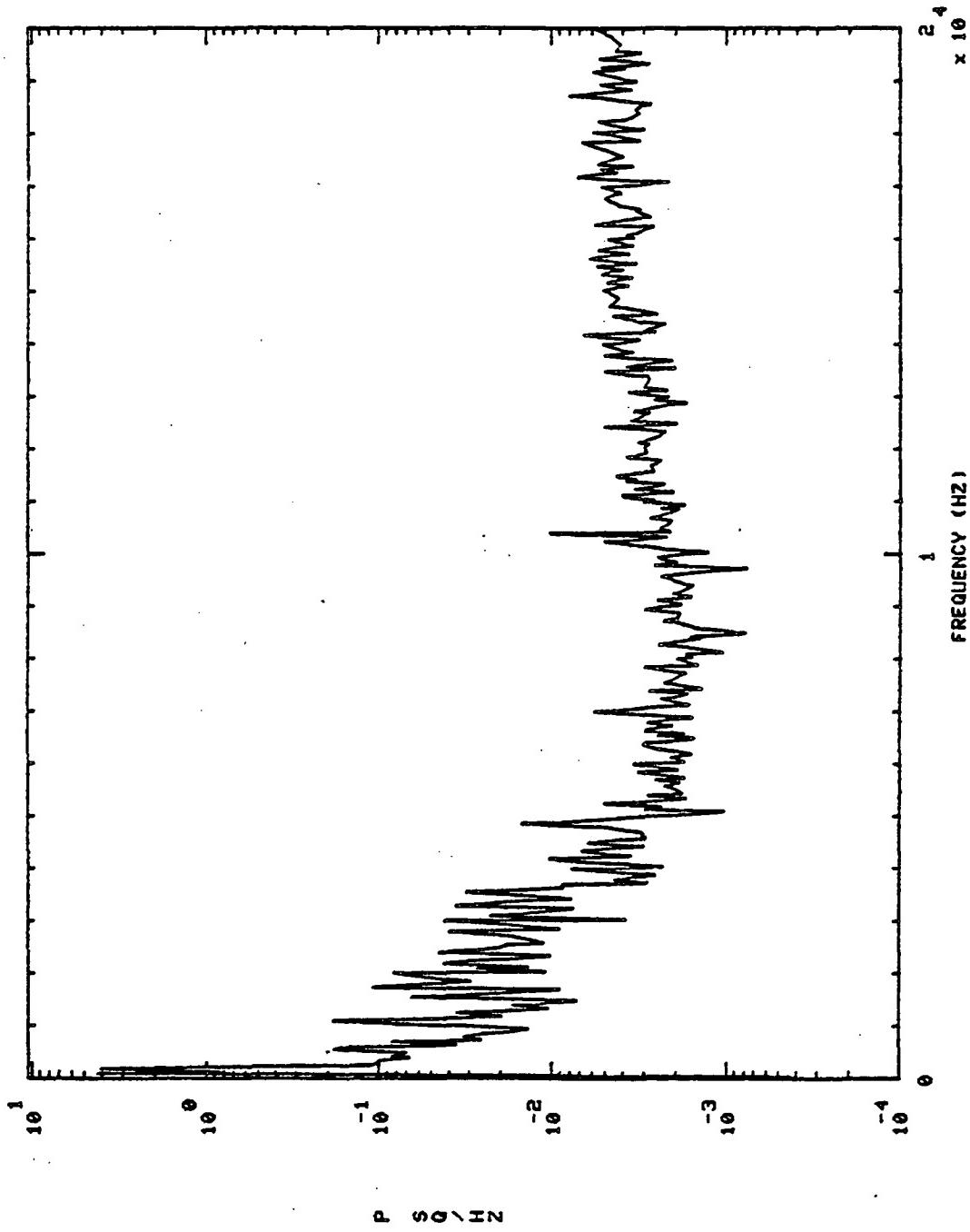
901295 HPOP DS PR



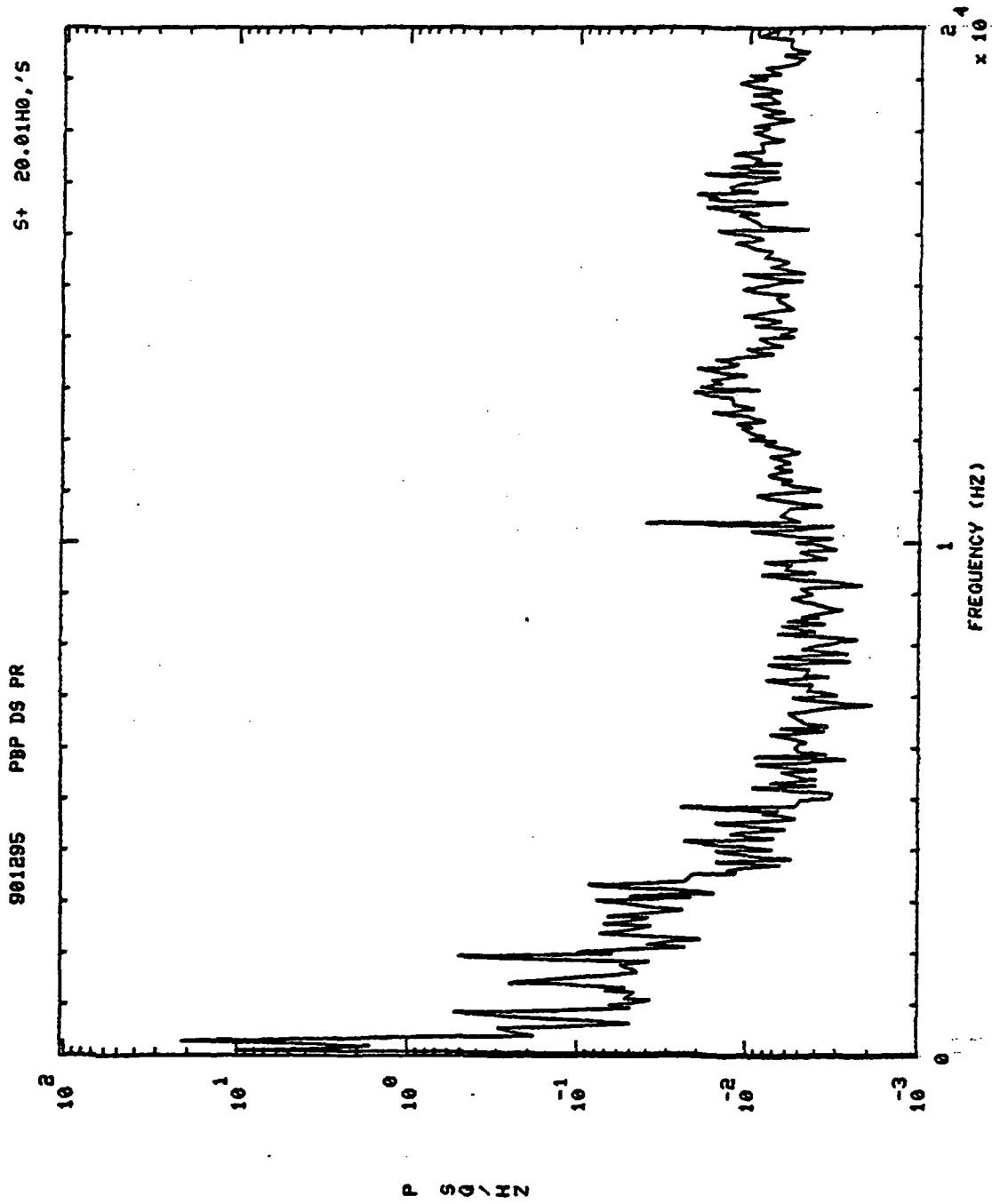


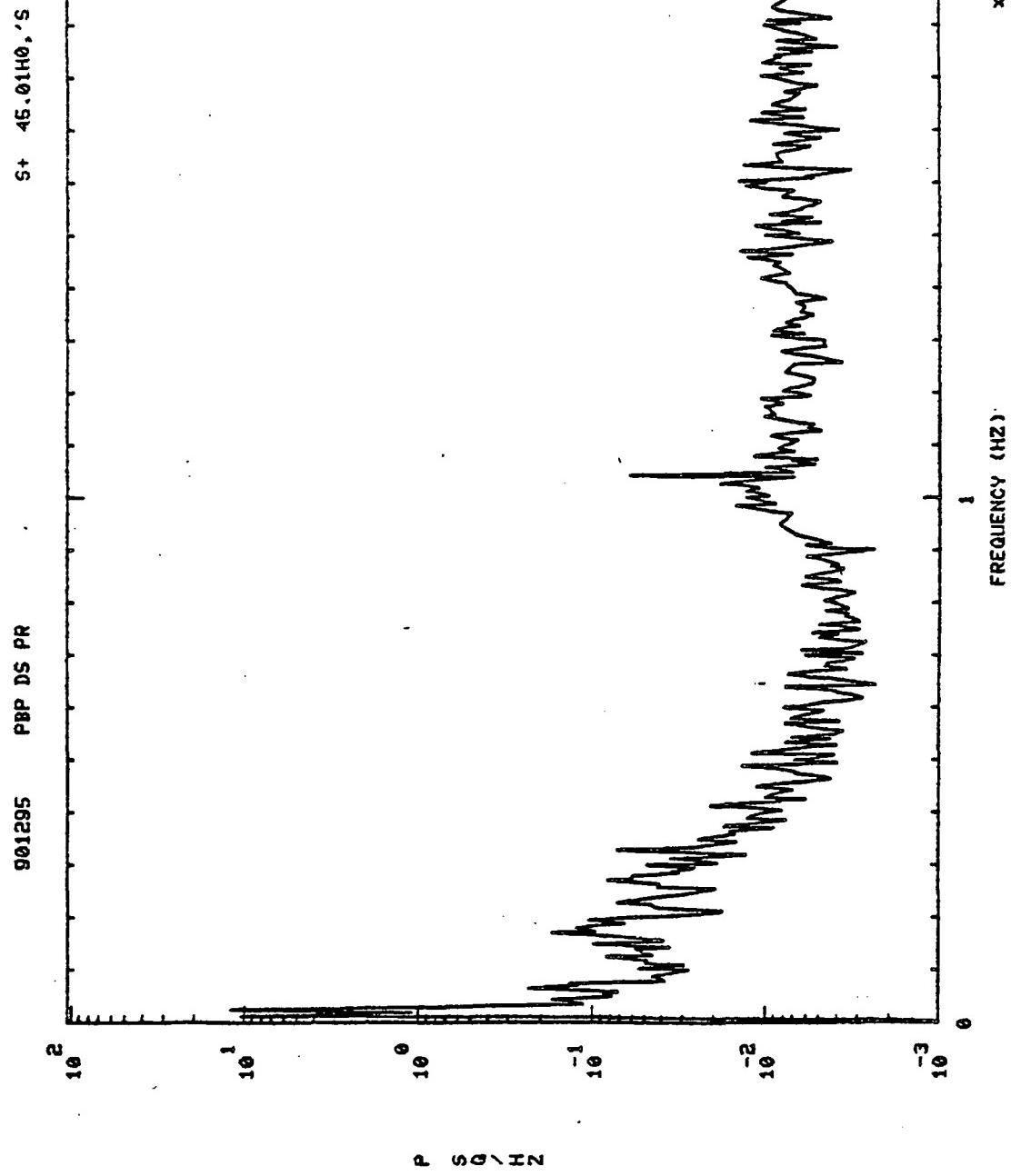
S+ 500.01H0.'S

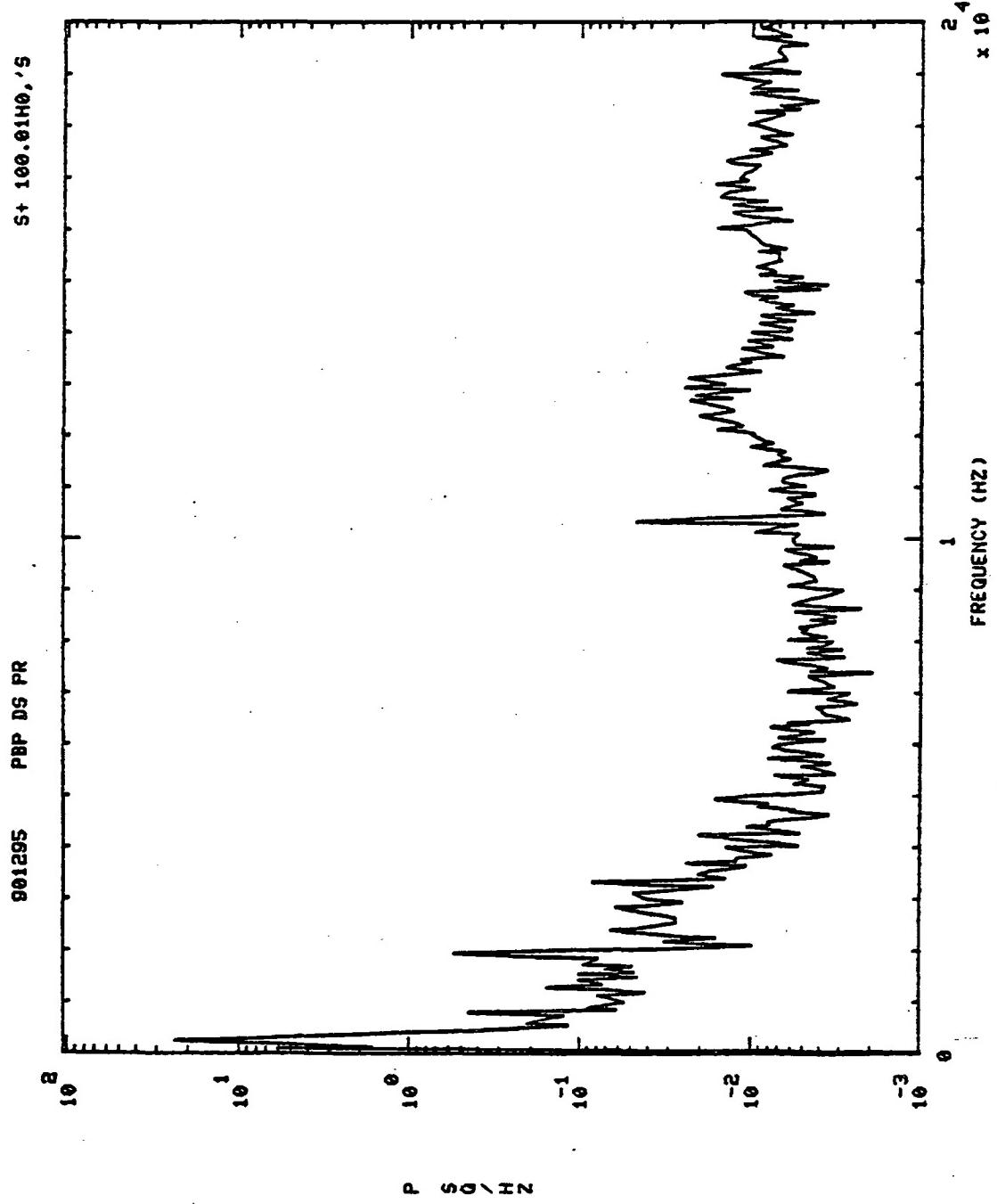
901295 HPOP DS PR



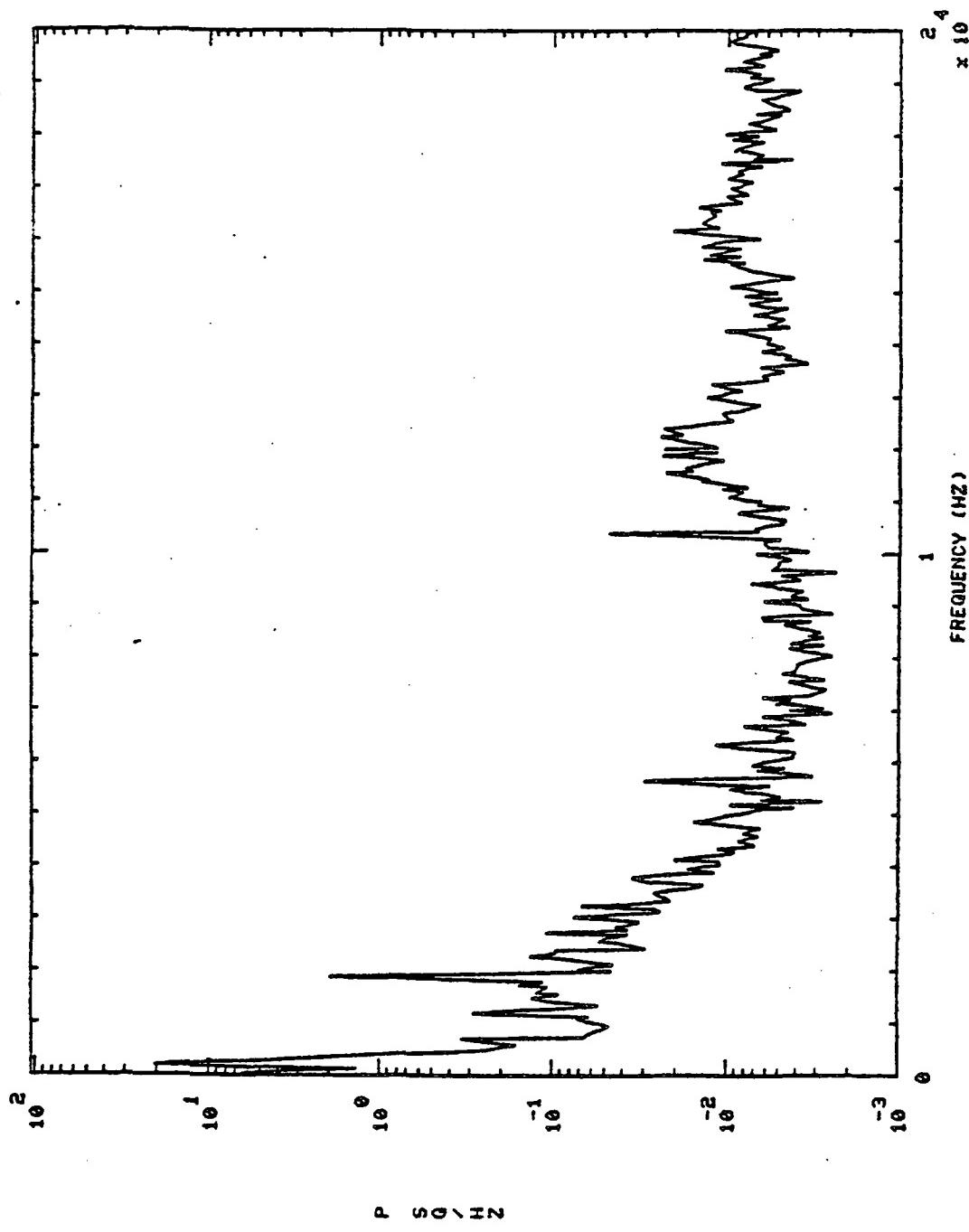
POWER SPECTRAL DENSITY

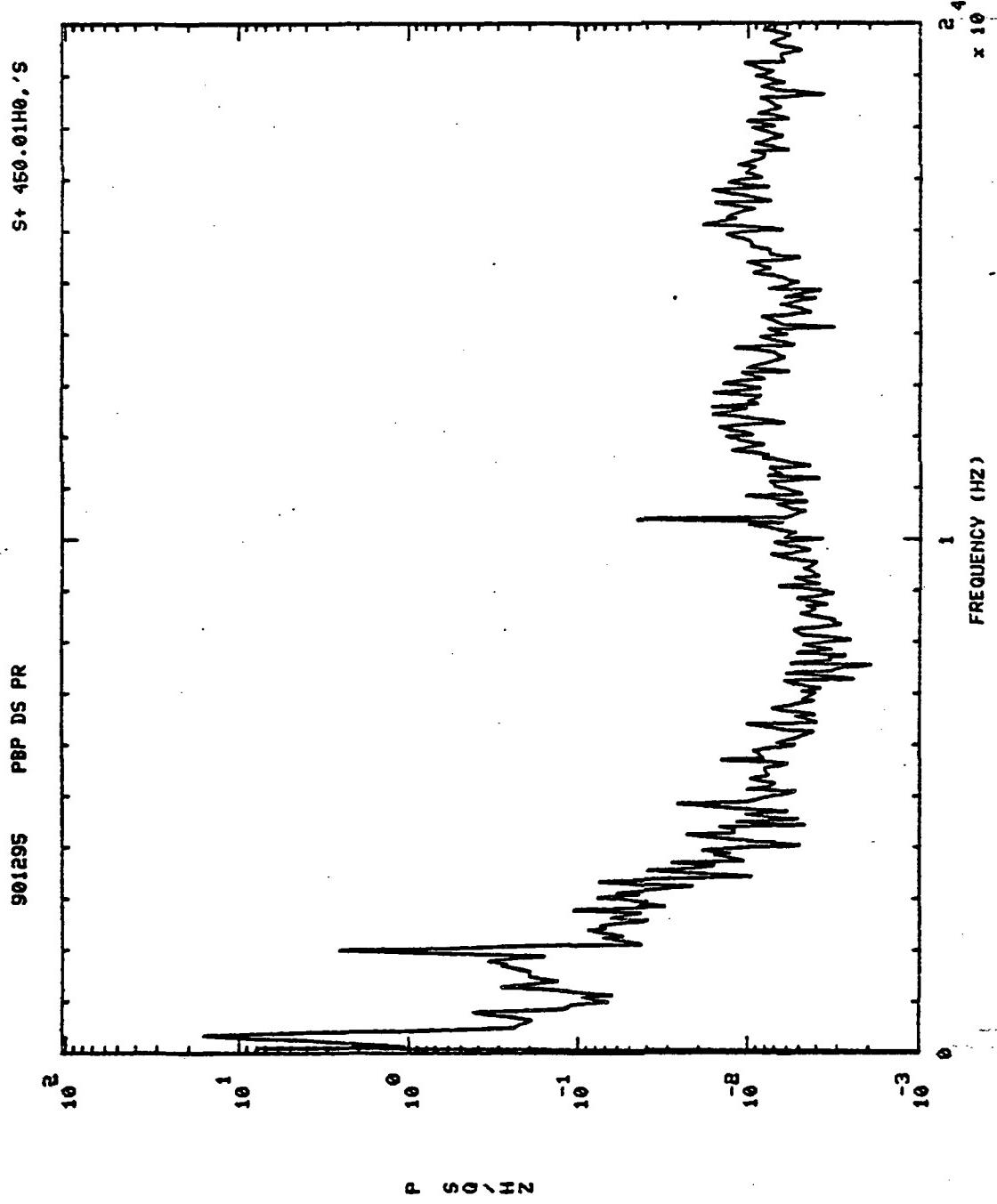






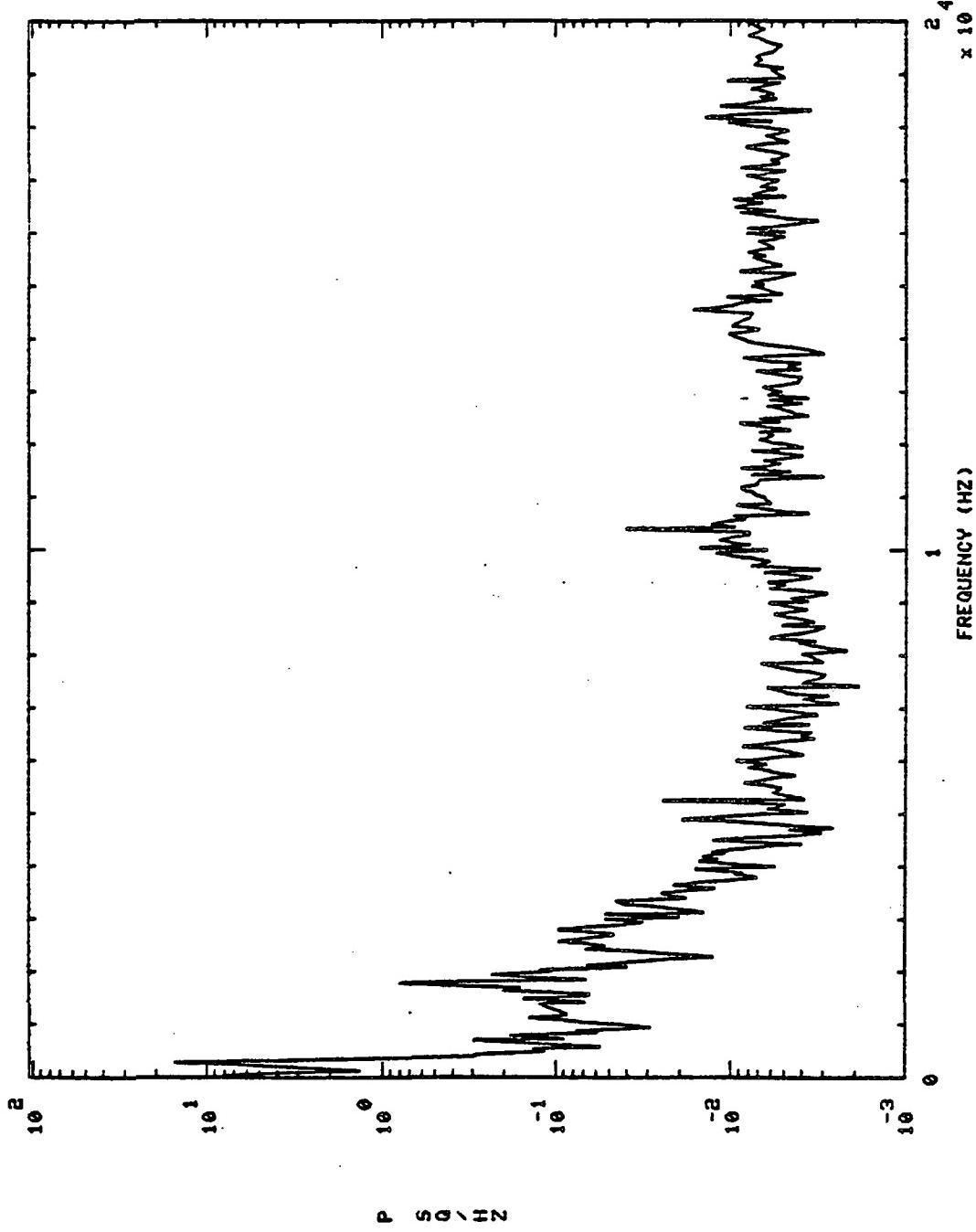
S+ 300.01H0.'S
901295 PBP DS PR

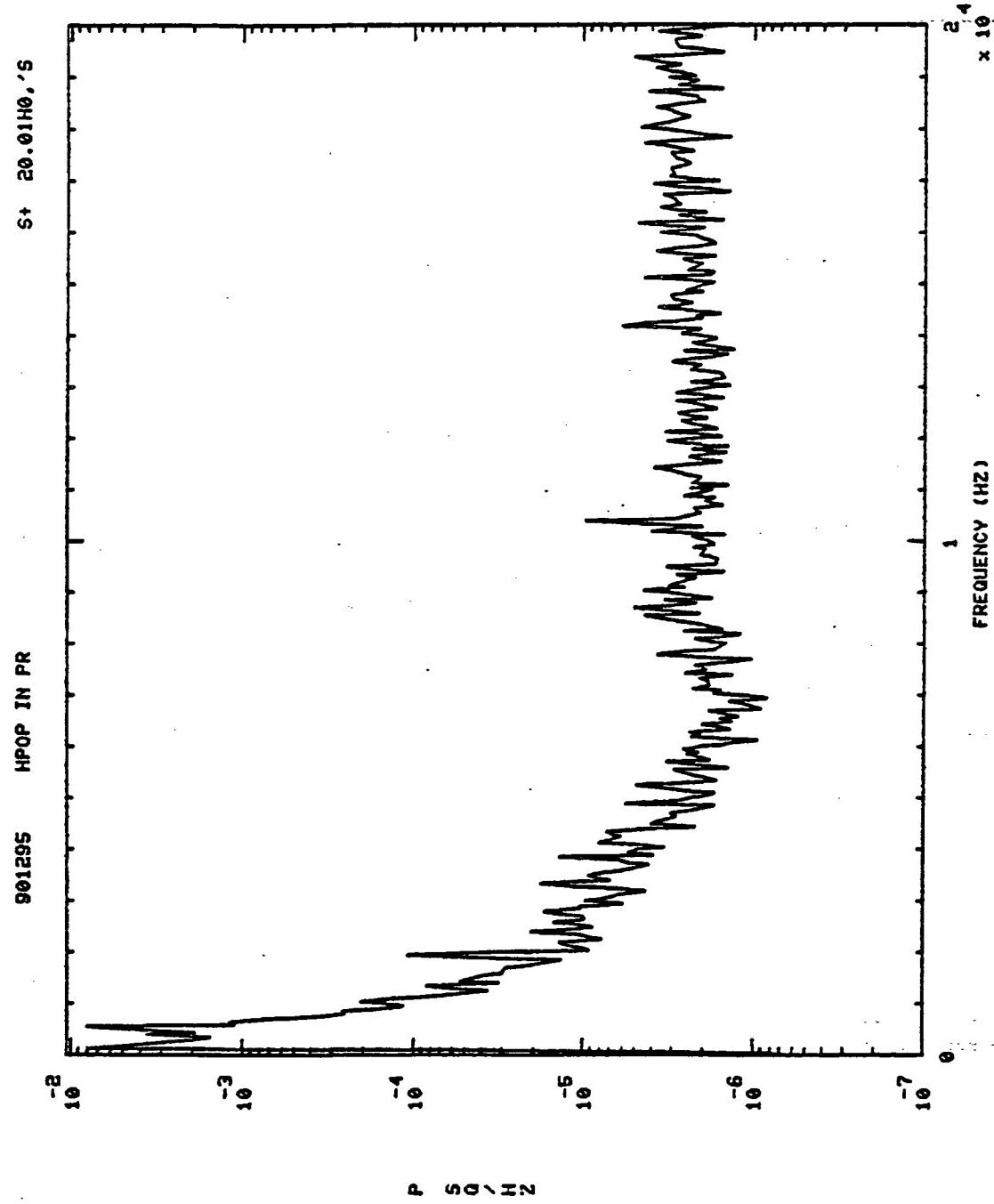




S+ 500.01H0.'S

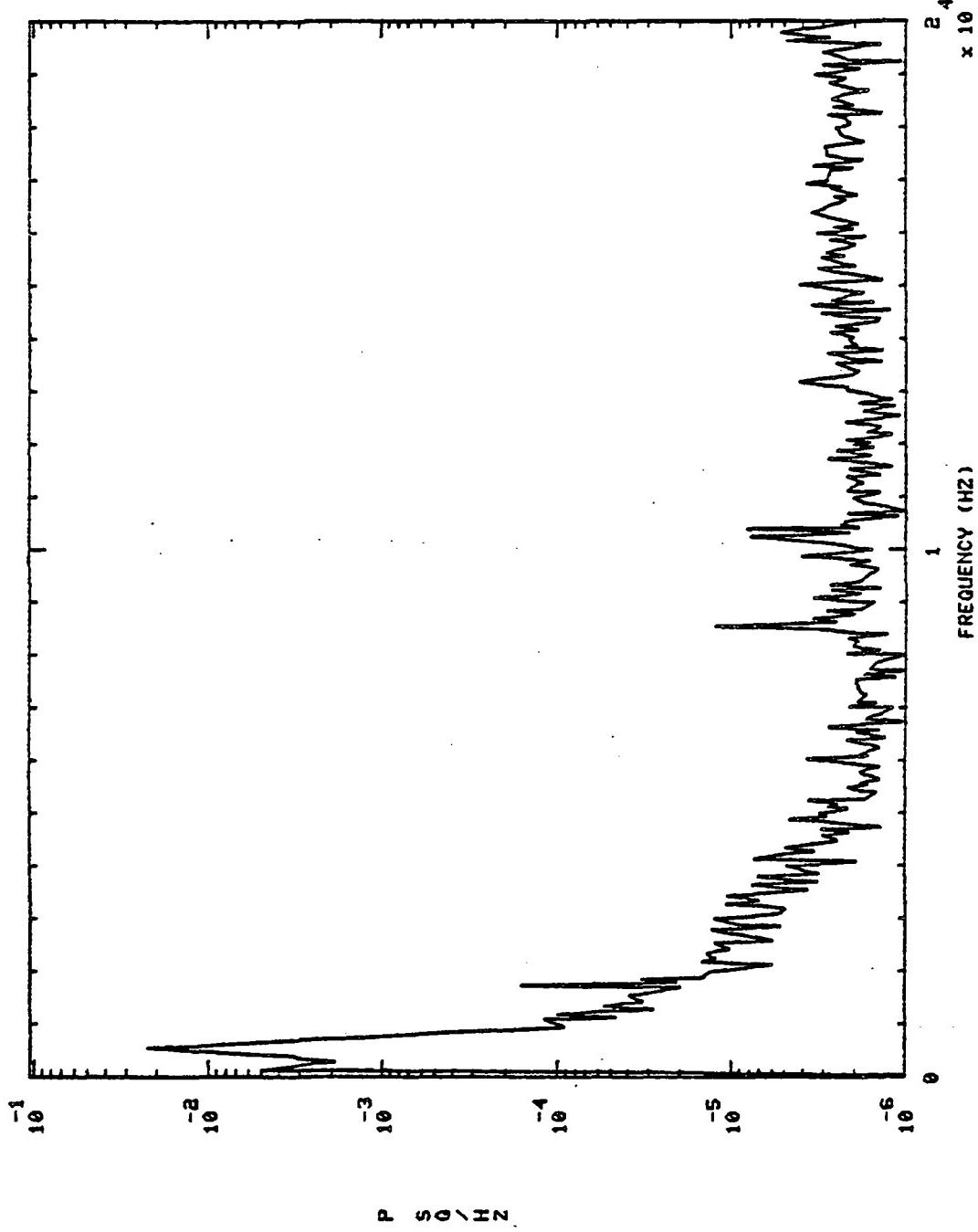
901295 PBP DS PR



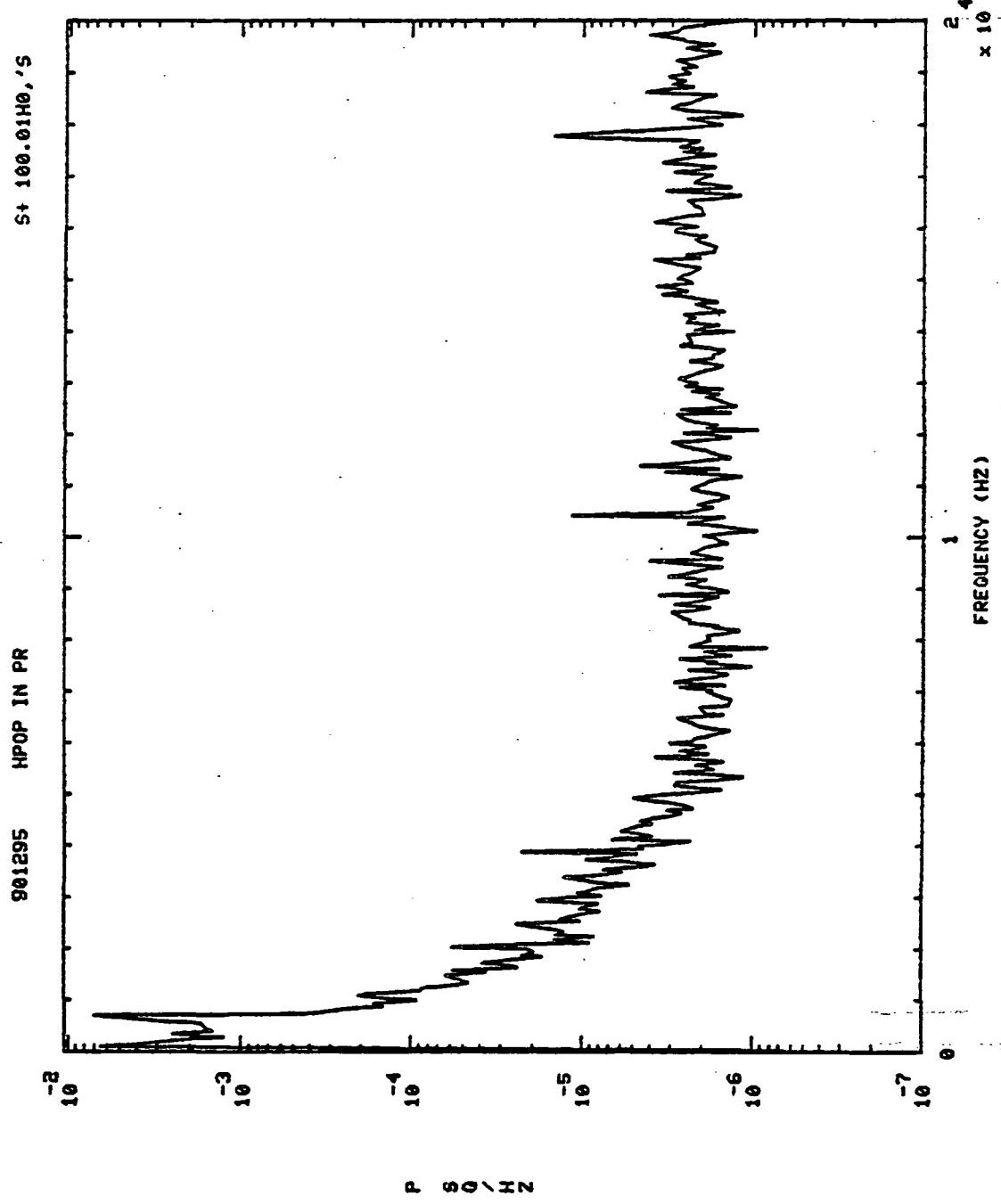


S+ 45.01H0, S

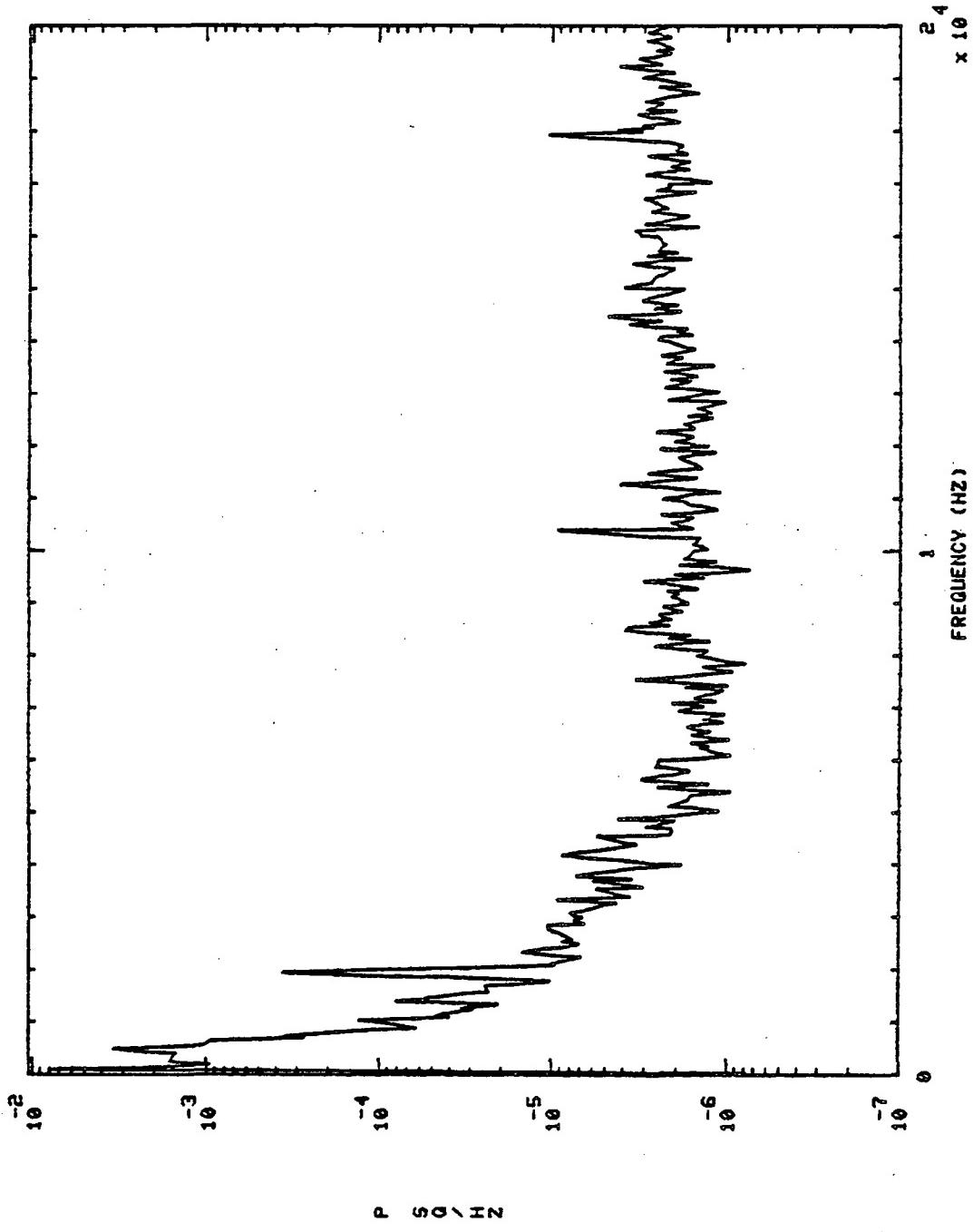
901295 HPOP IN PR

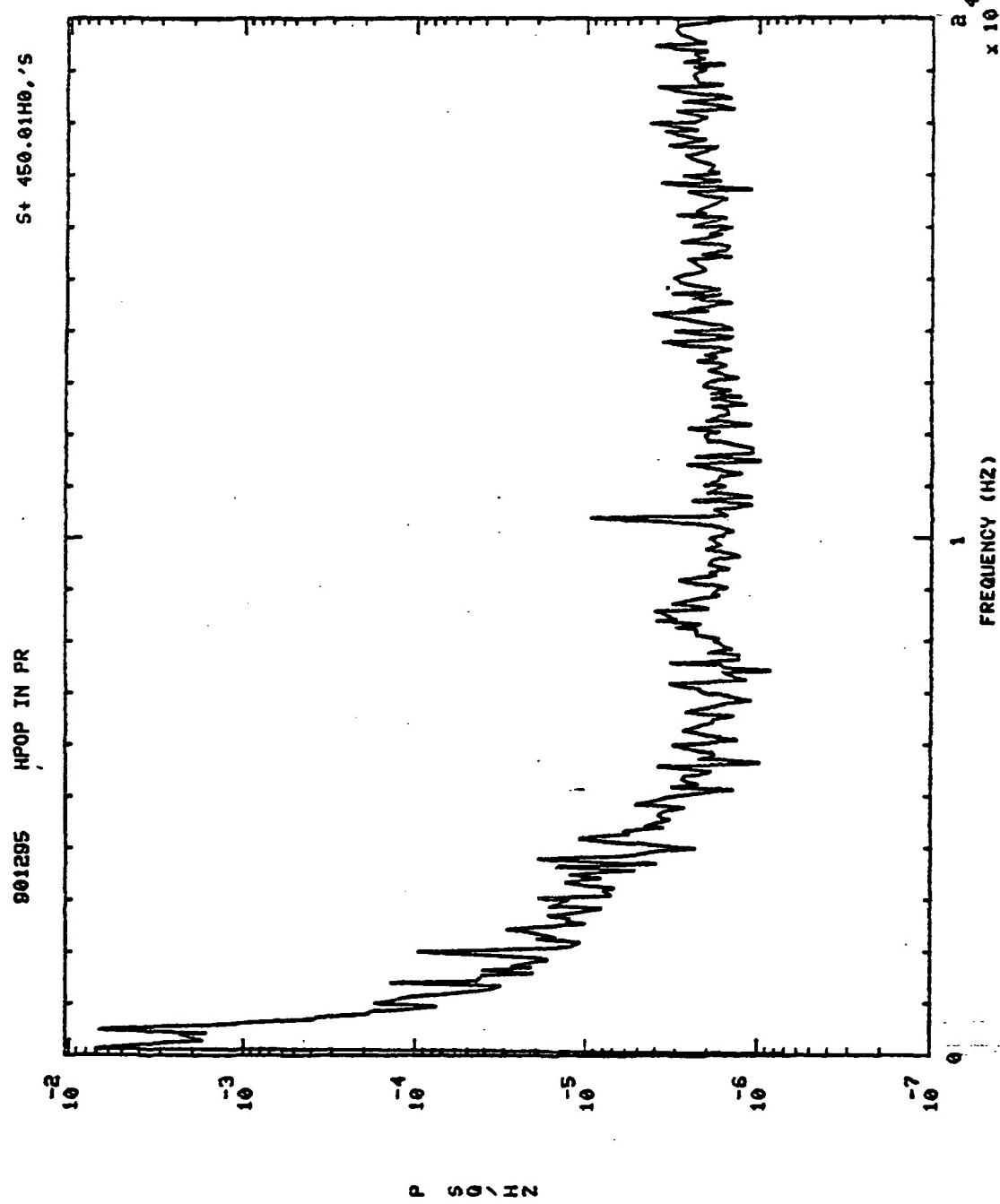


P SC/Hz



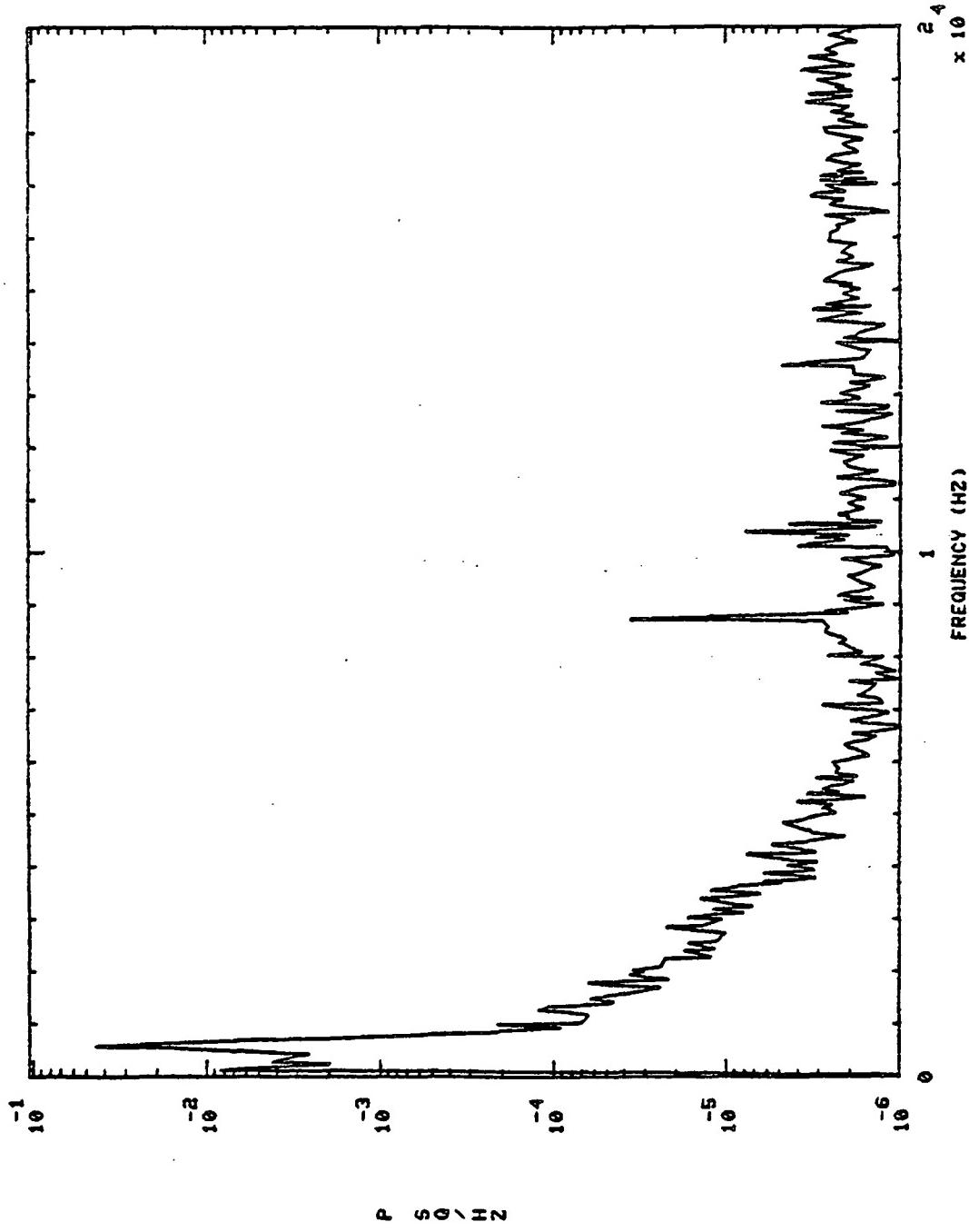
901295 HPOP IN PR S+ 300.01H0.'S





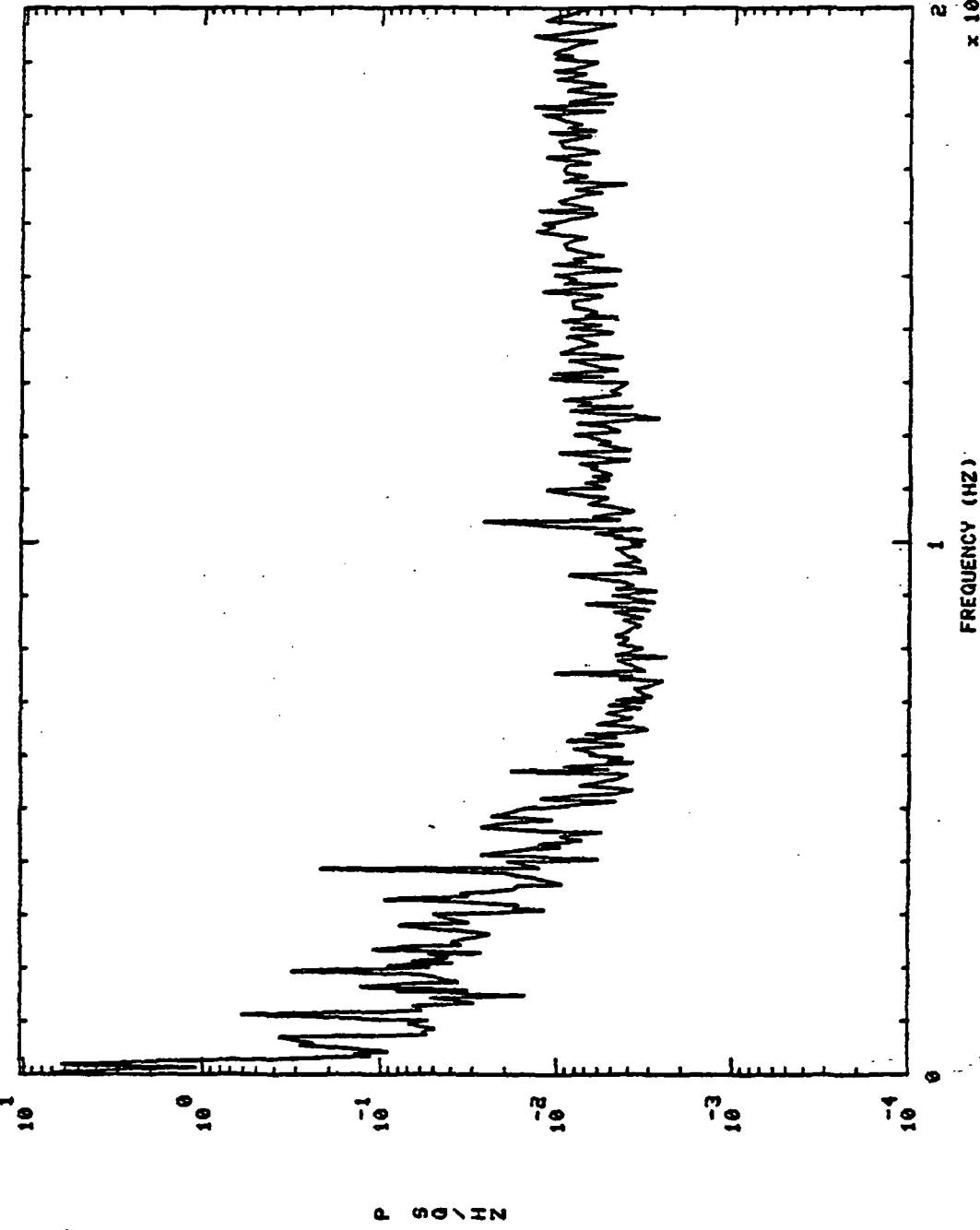
S+ 500.01 H0.'5

901295 HPOP IN PR



S+ 20.01H0.'S

901295 QPB PC PR DC

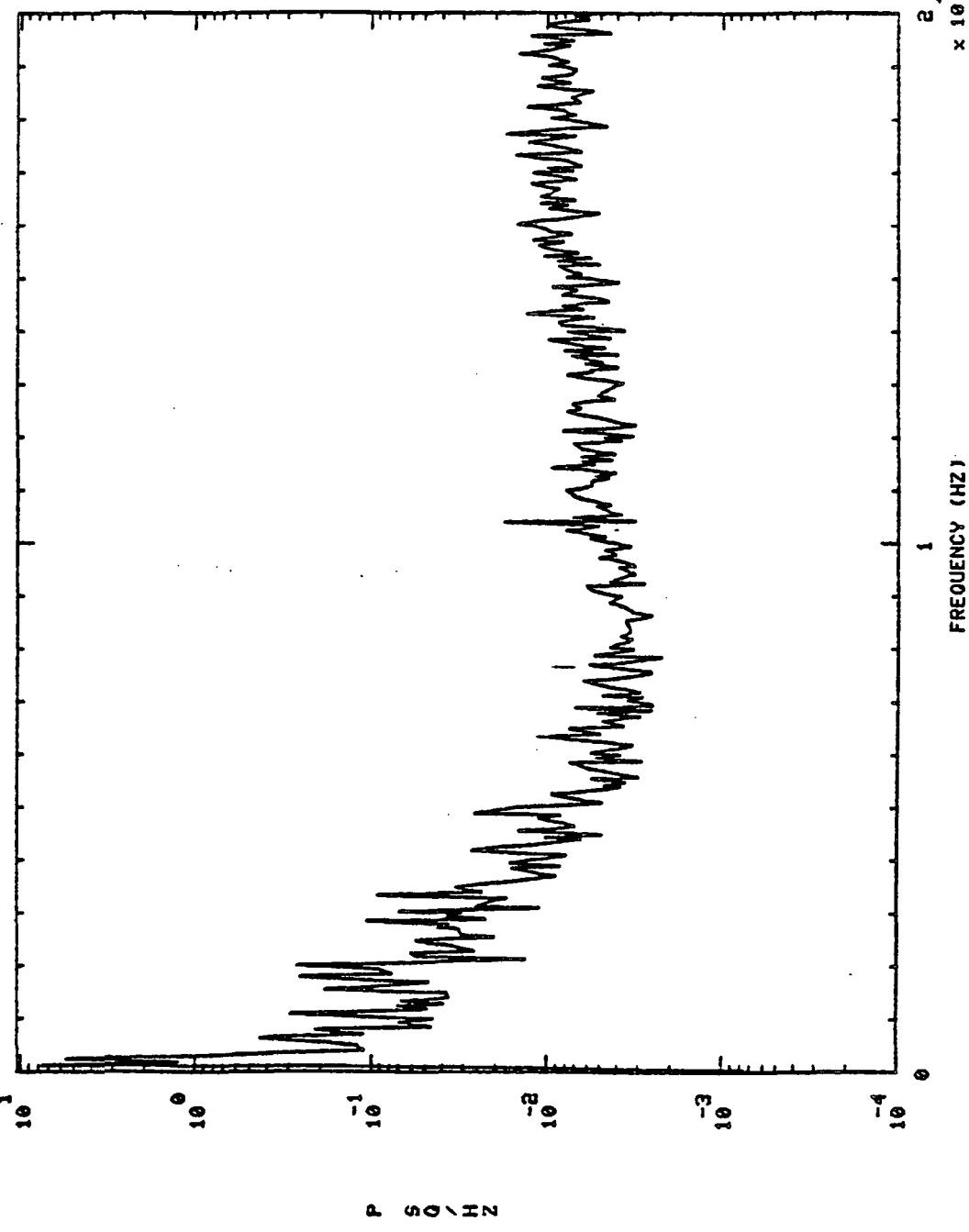


P S Q / HZ

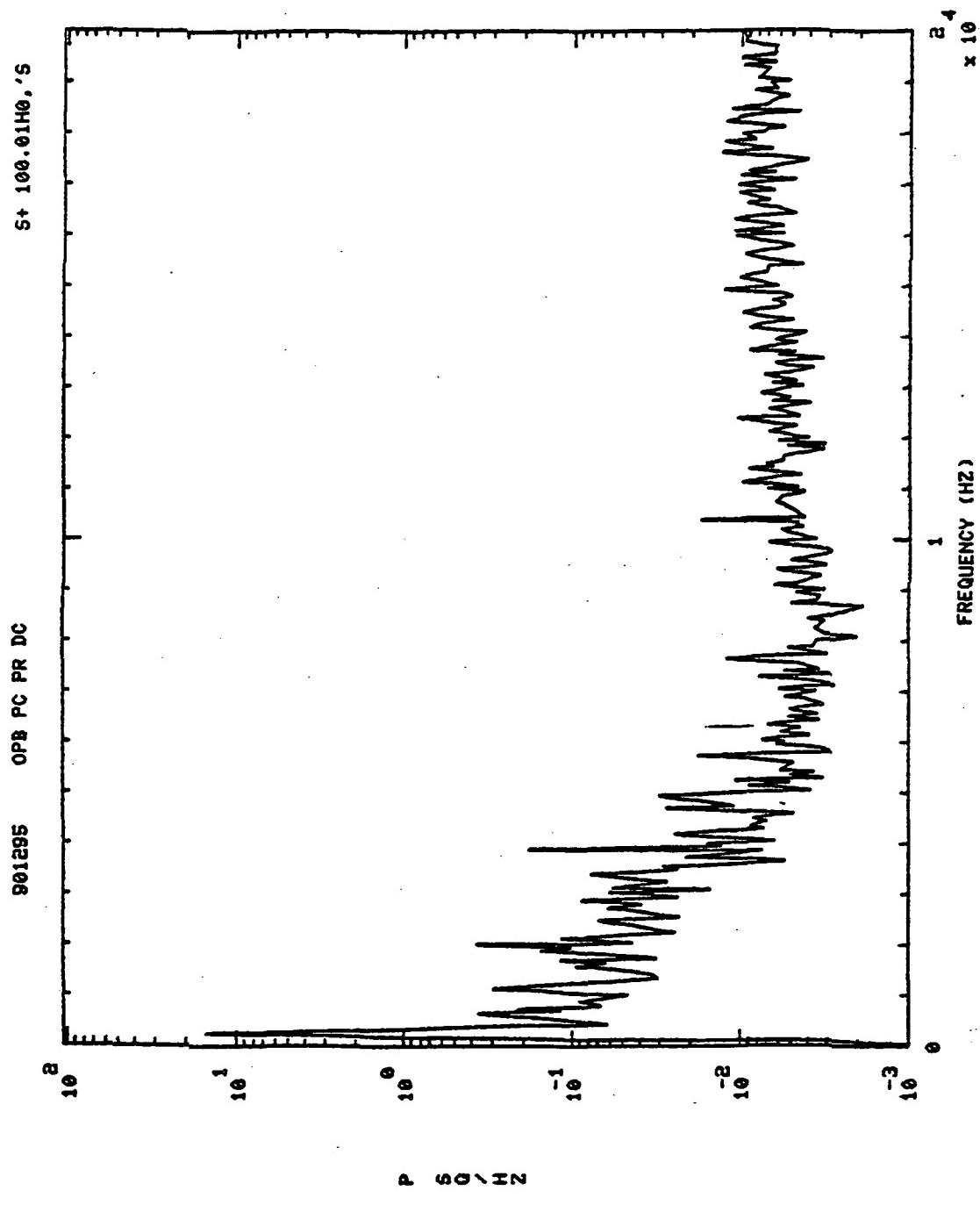
S+ 45.01Hz, 'S

OPB PC PR DC

9612295

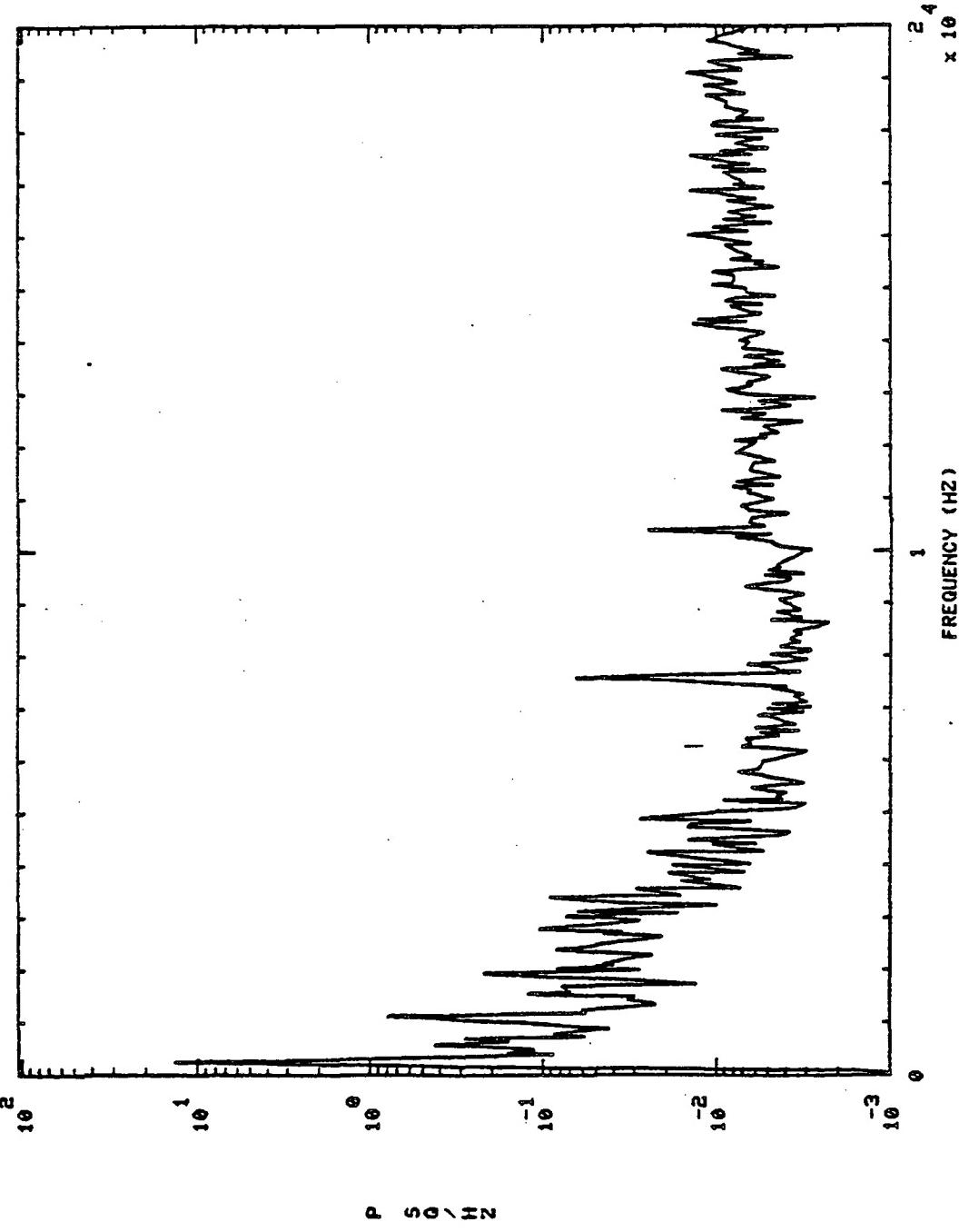


P S Q / HZ



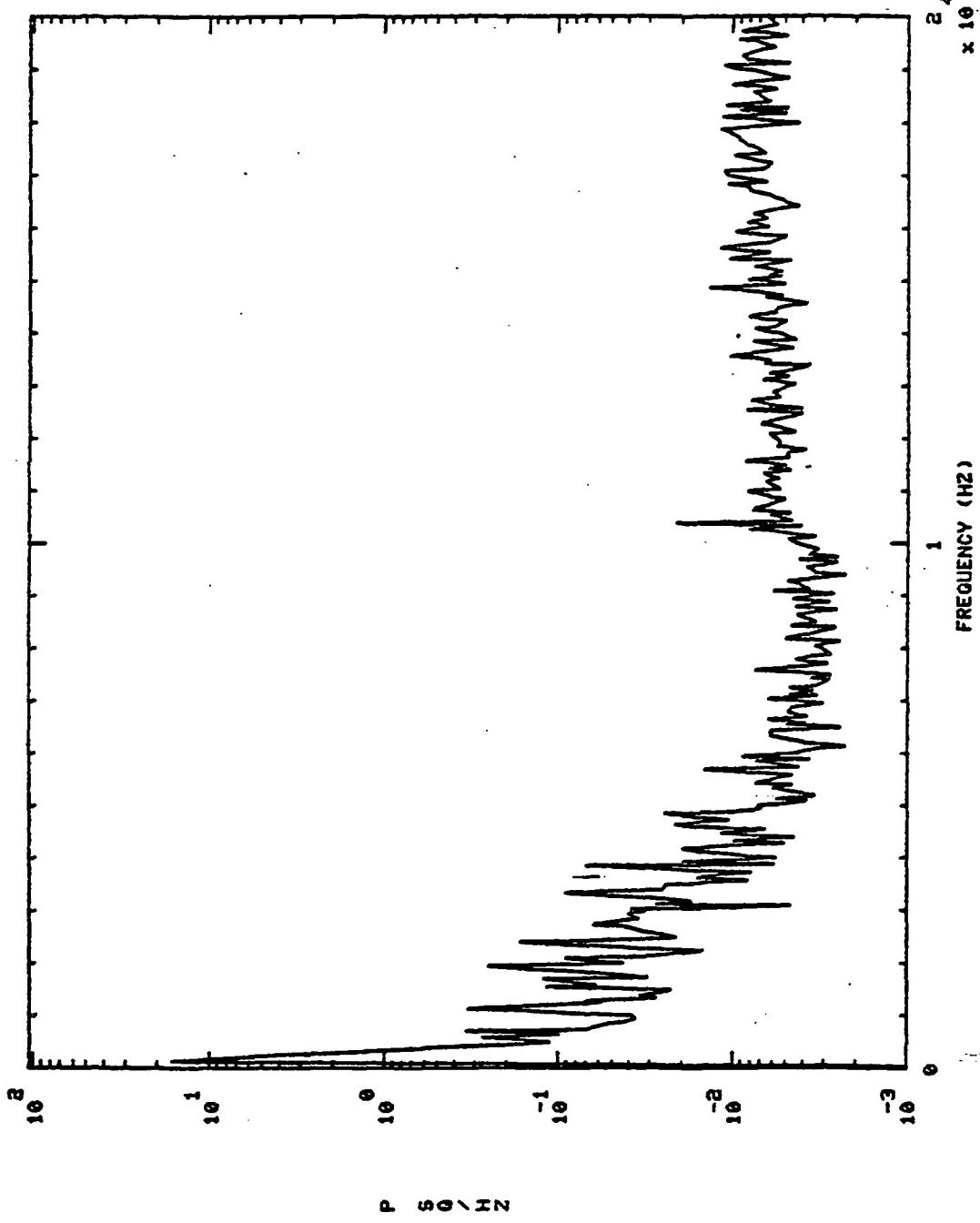
S+ 300.01H0, 'S

901295 OPS PC PR DC



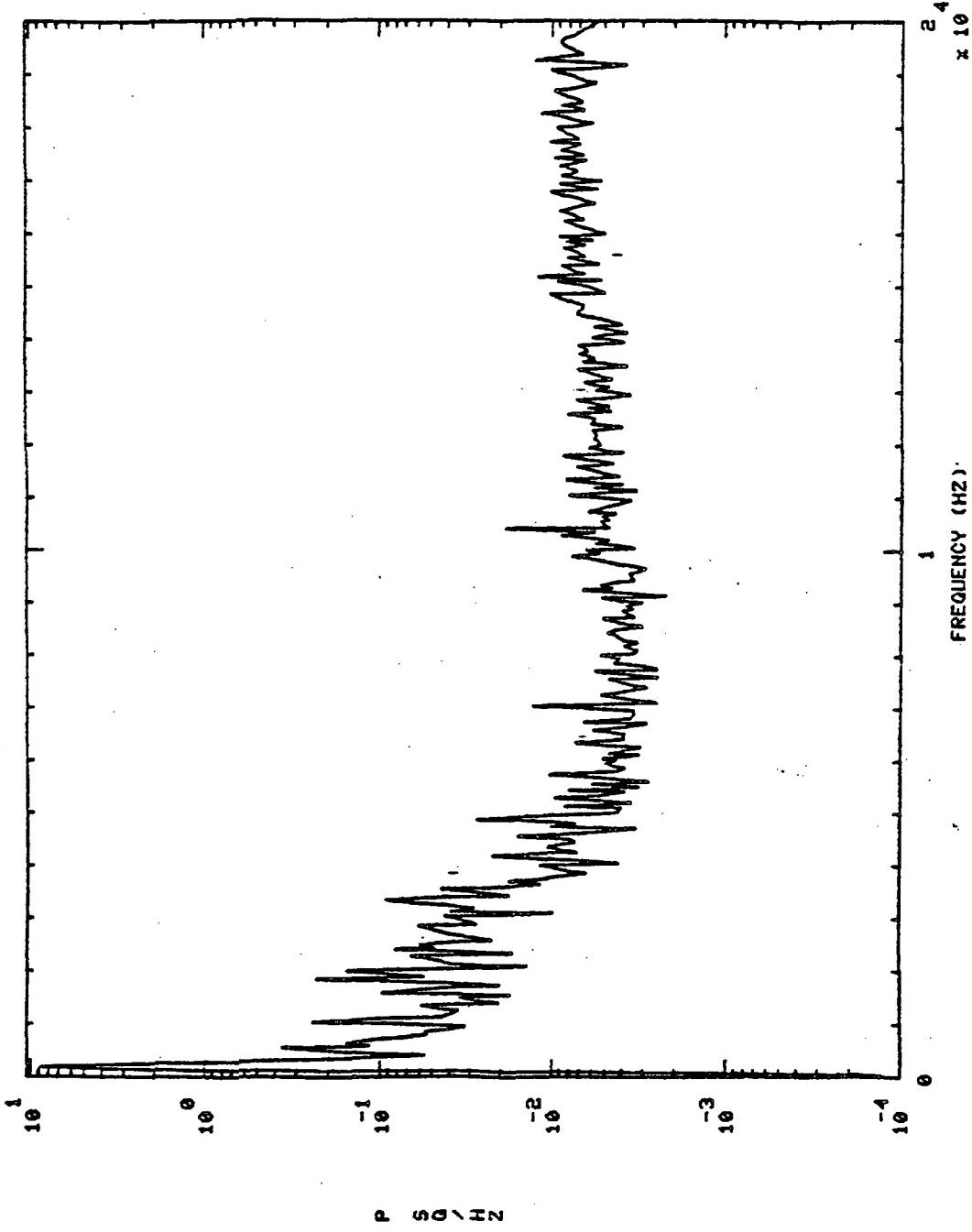
981295 OPB PC PR DC

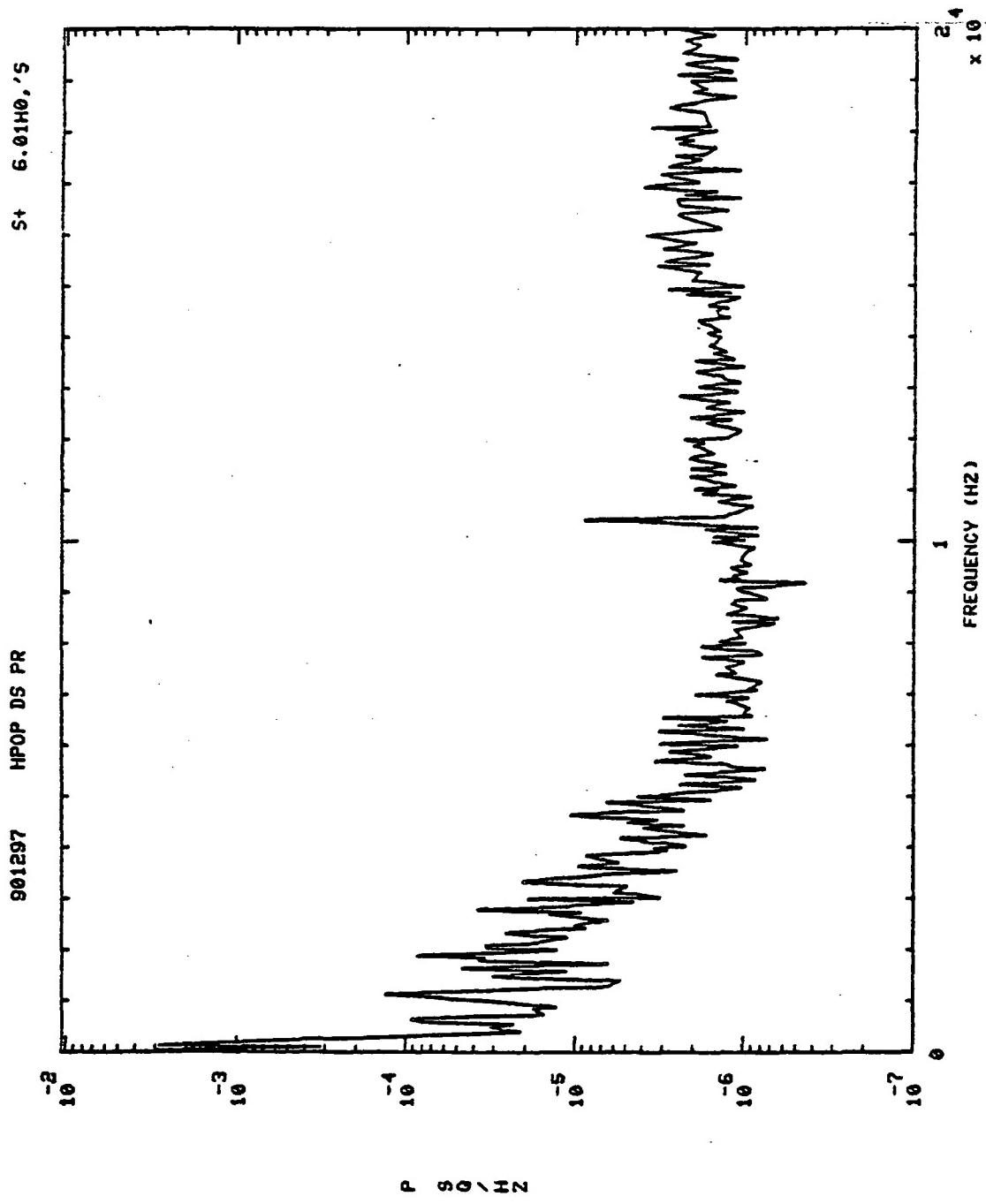
S+ 450.01Hz, 's

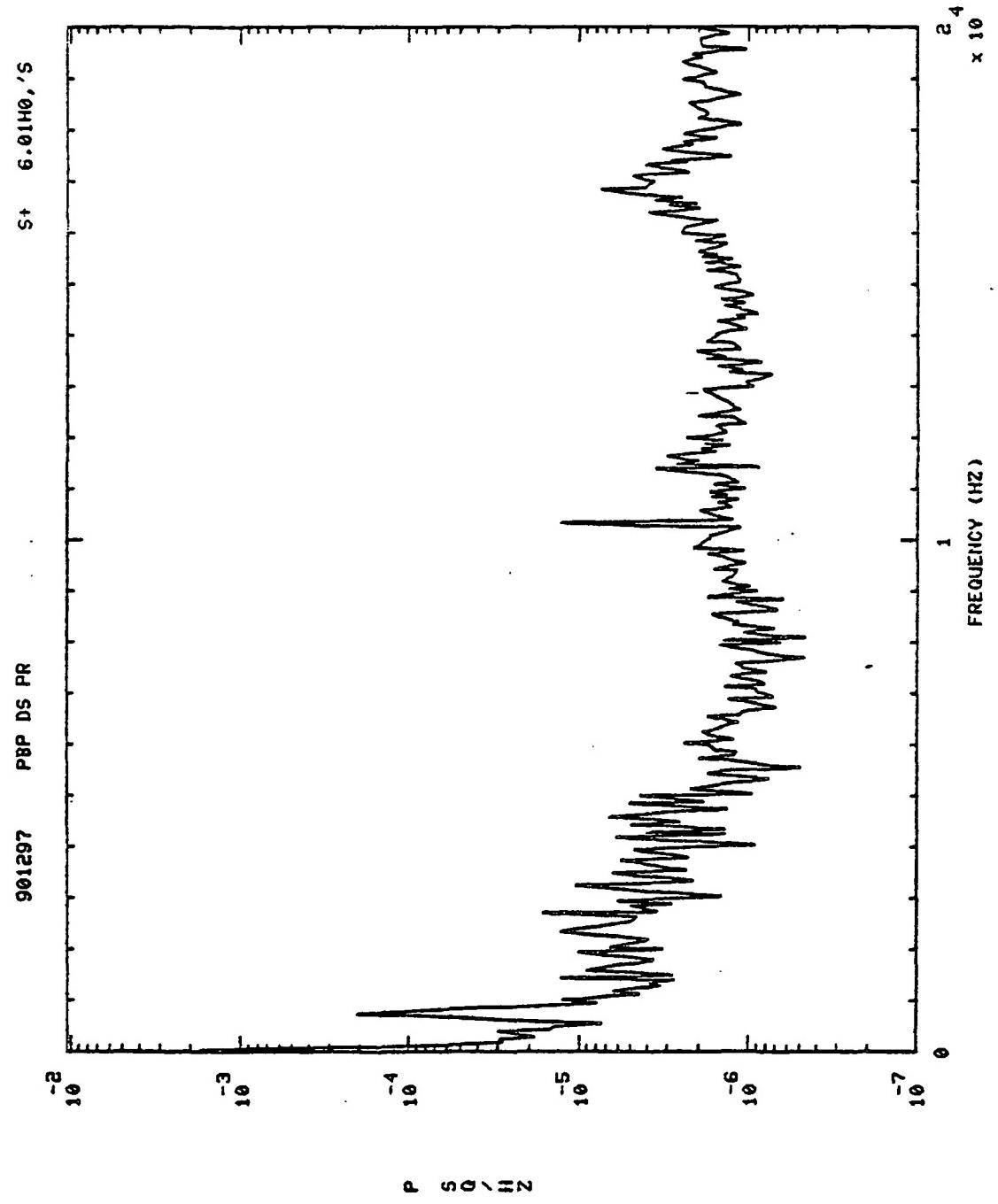


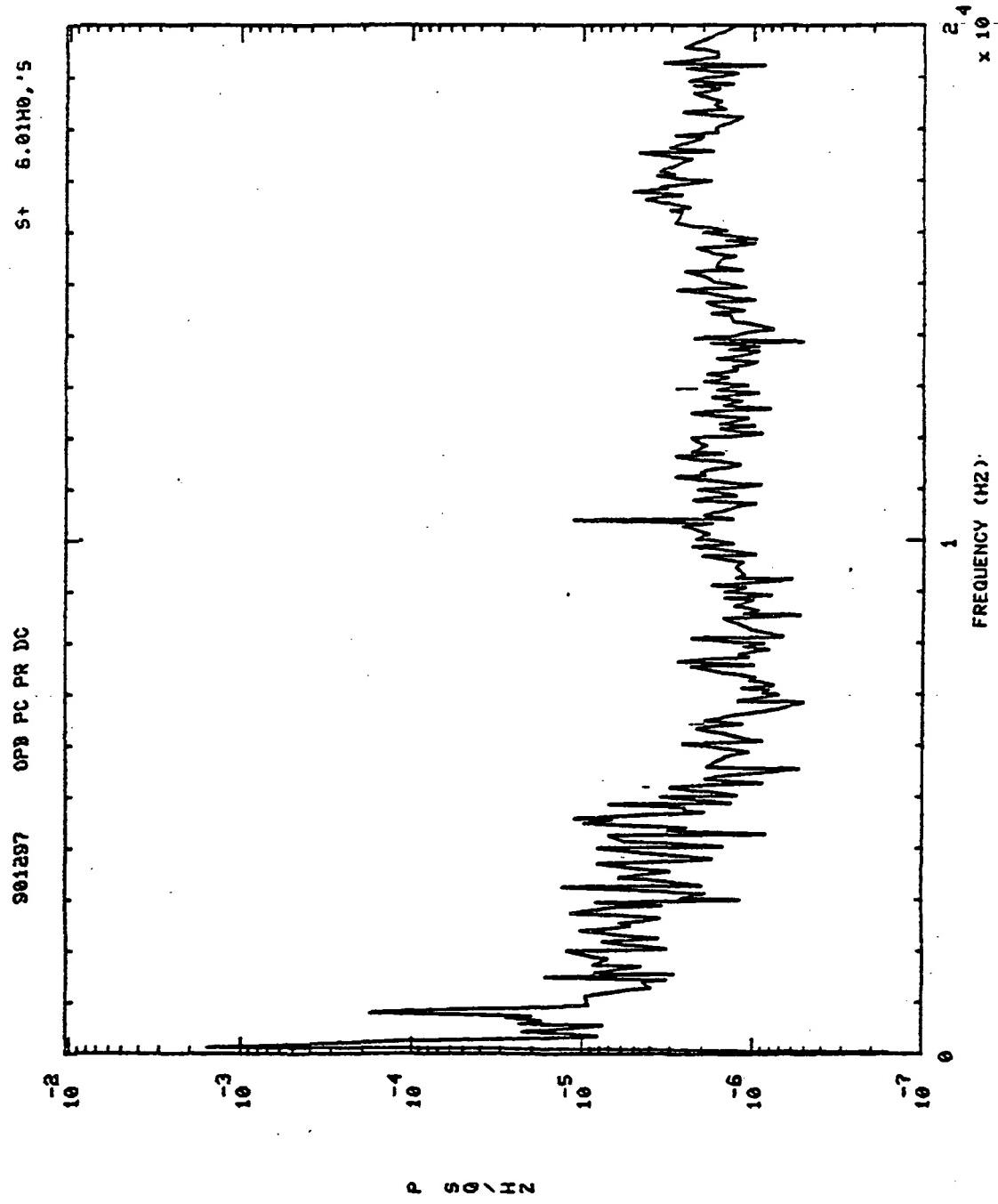
S+ 500.01H0.5

901295 OPB PC PR DC









S+ 6.01H0.'S

901299 HPOP DS PR

10^{-2}

10^{-1}

10^0

10^{-1}

10^{-2}

10^{-3}

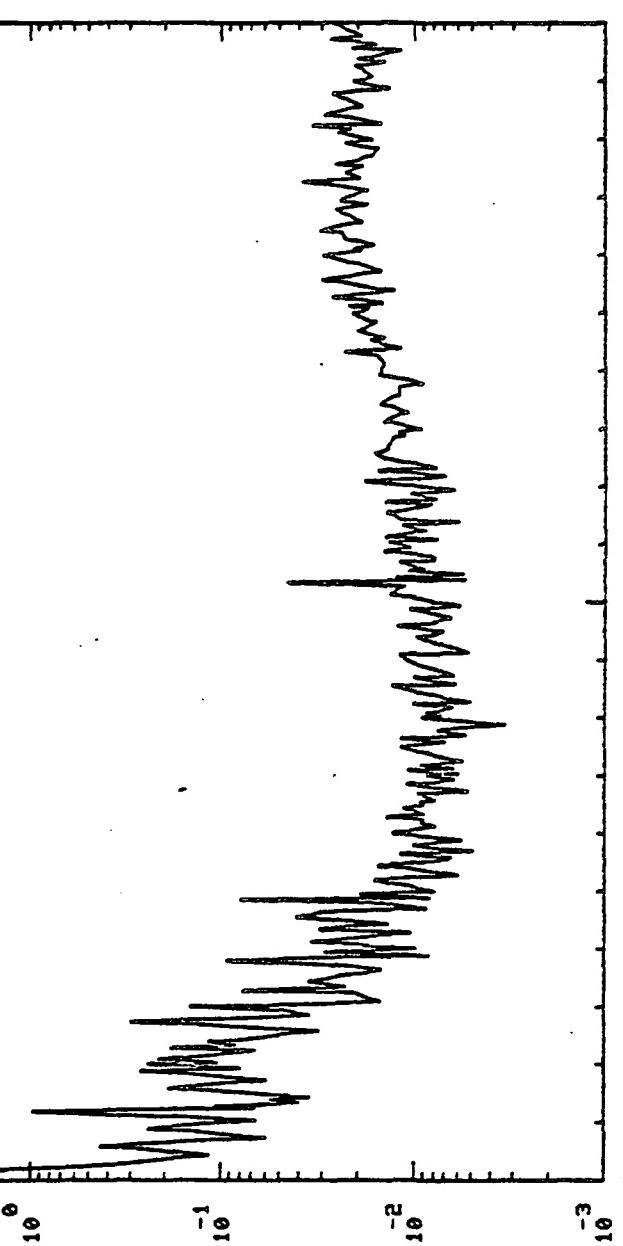
PSD / Hz

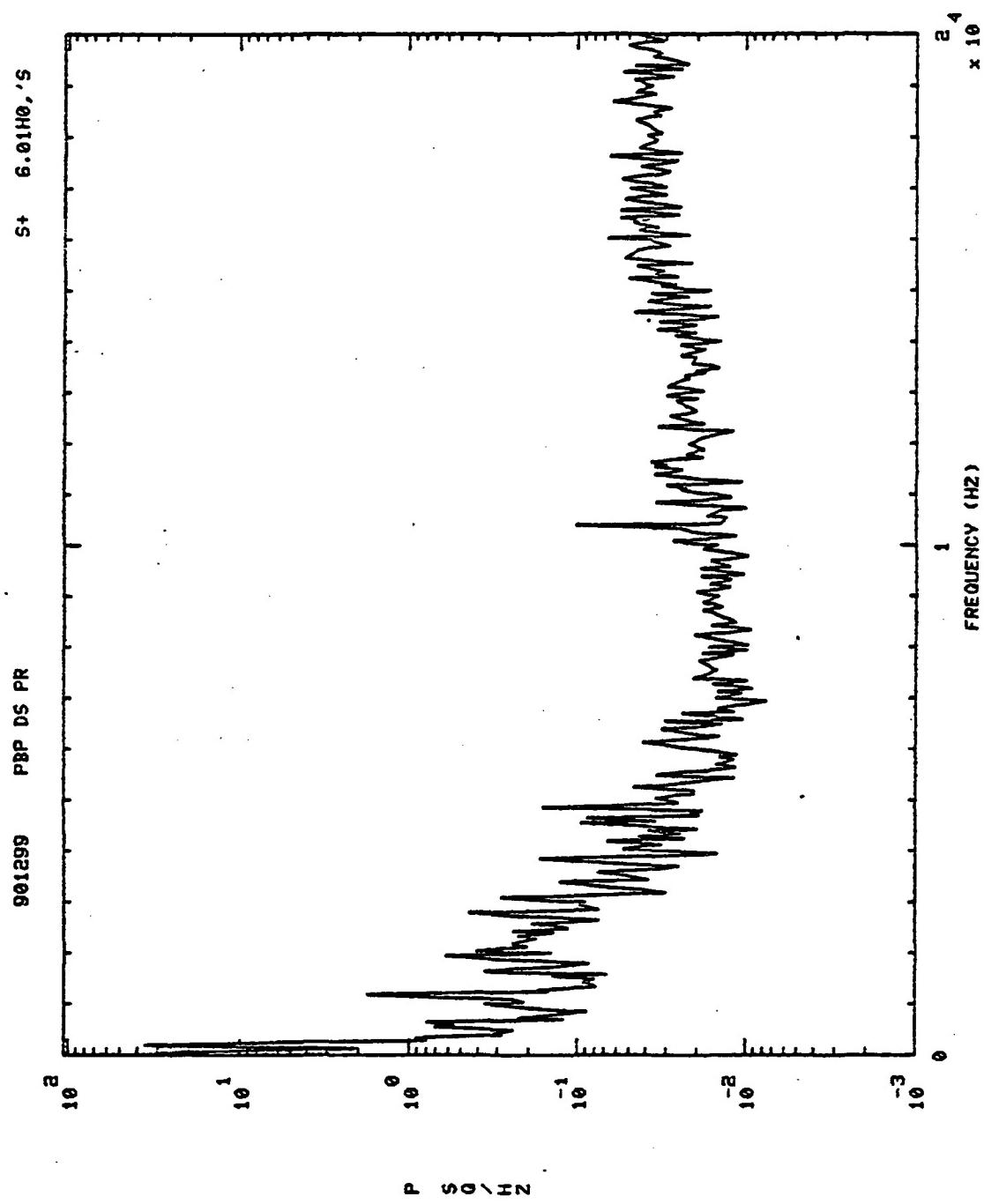
FREQUENCY (Hz)

$10^{2.4}$

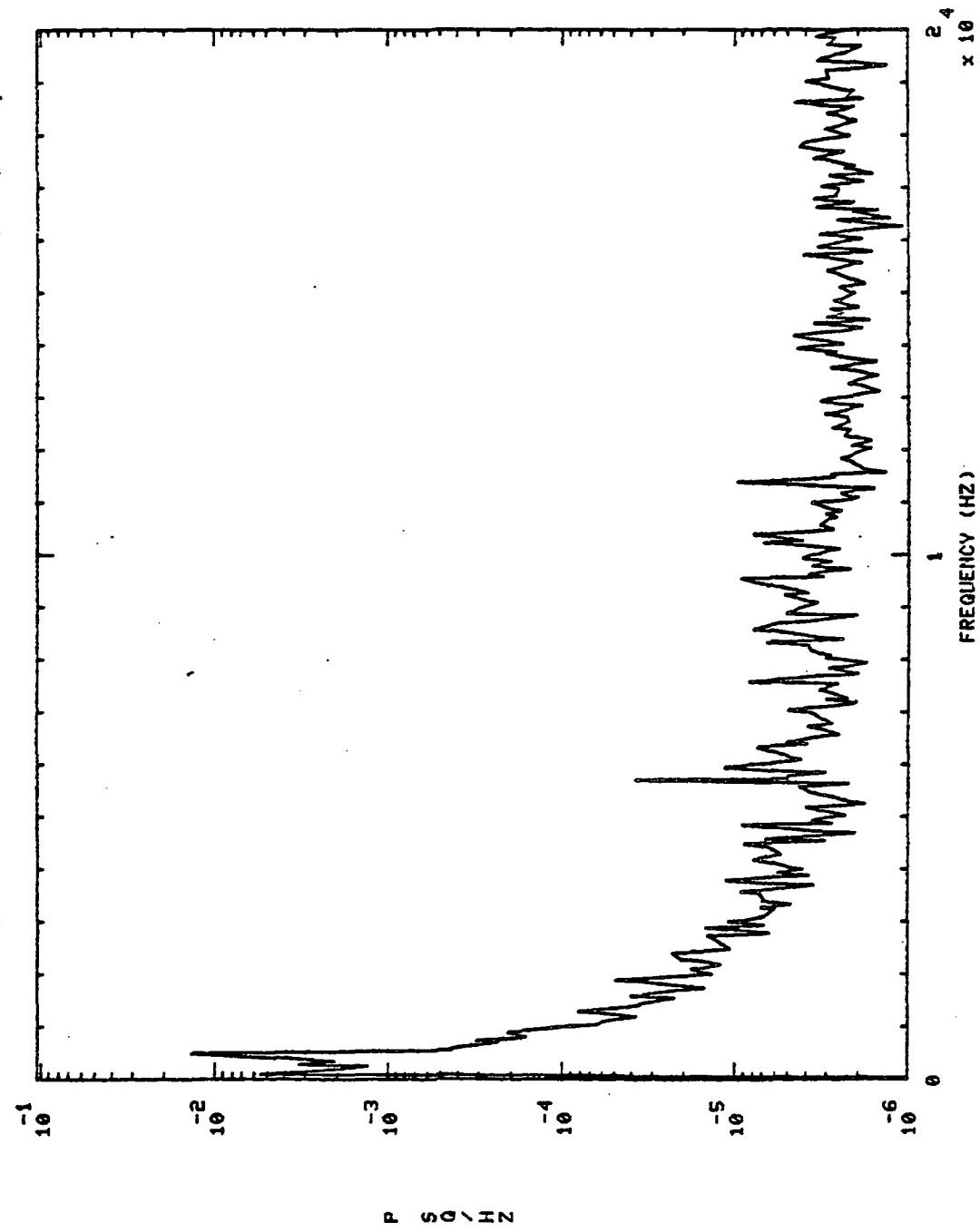
1

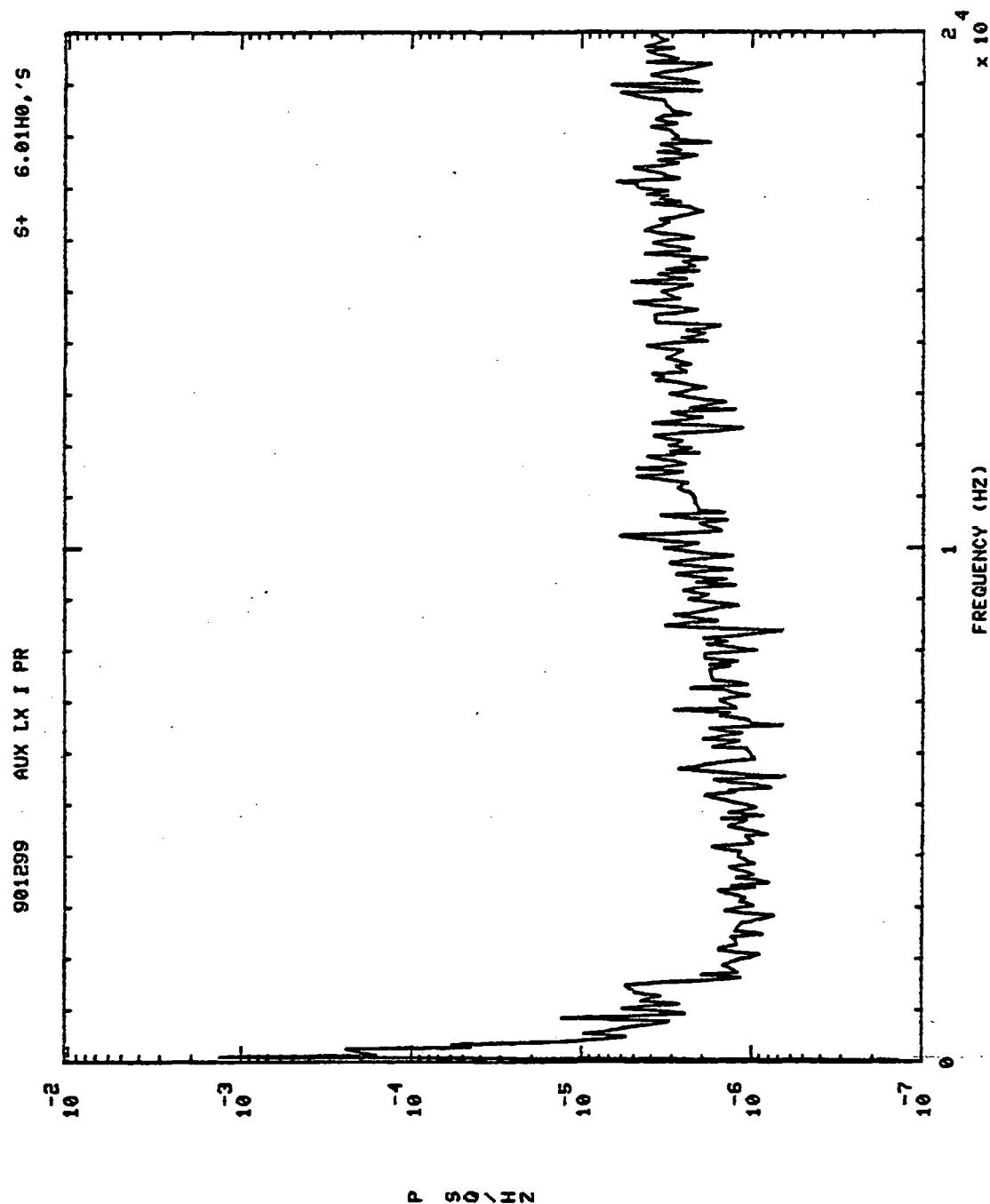
0

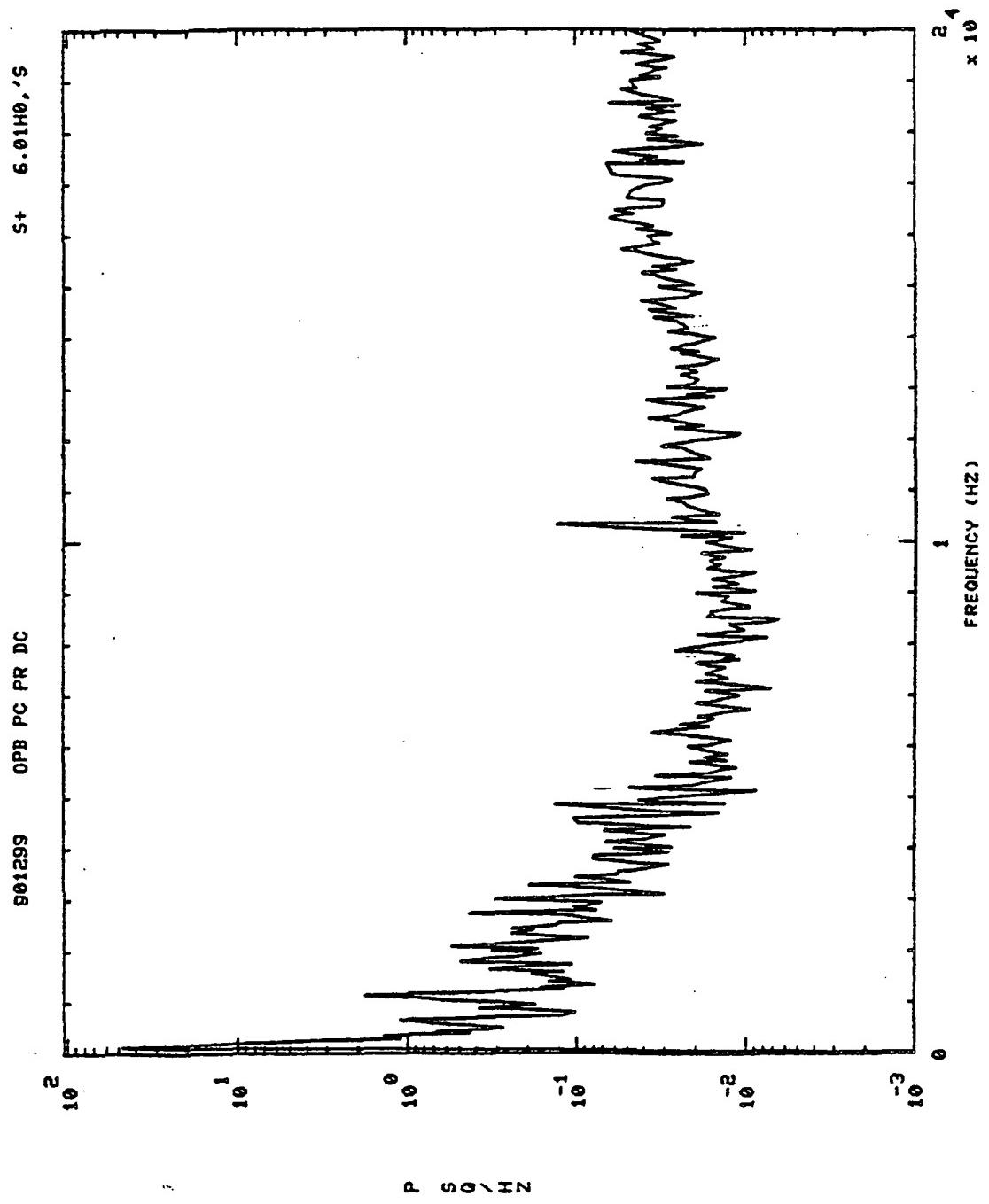


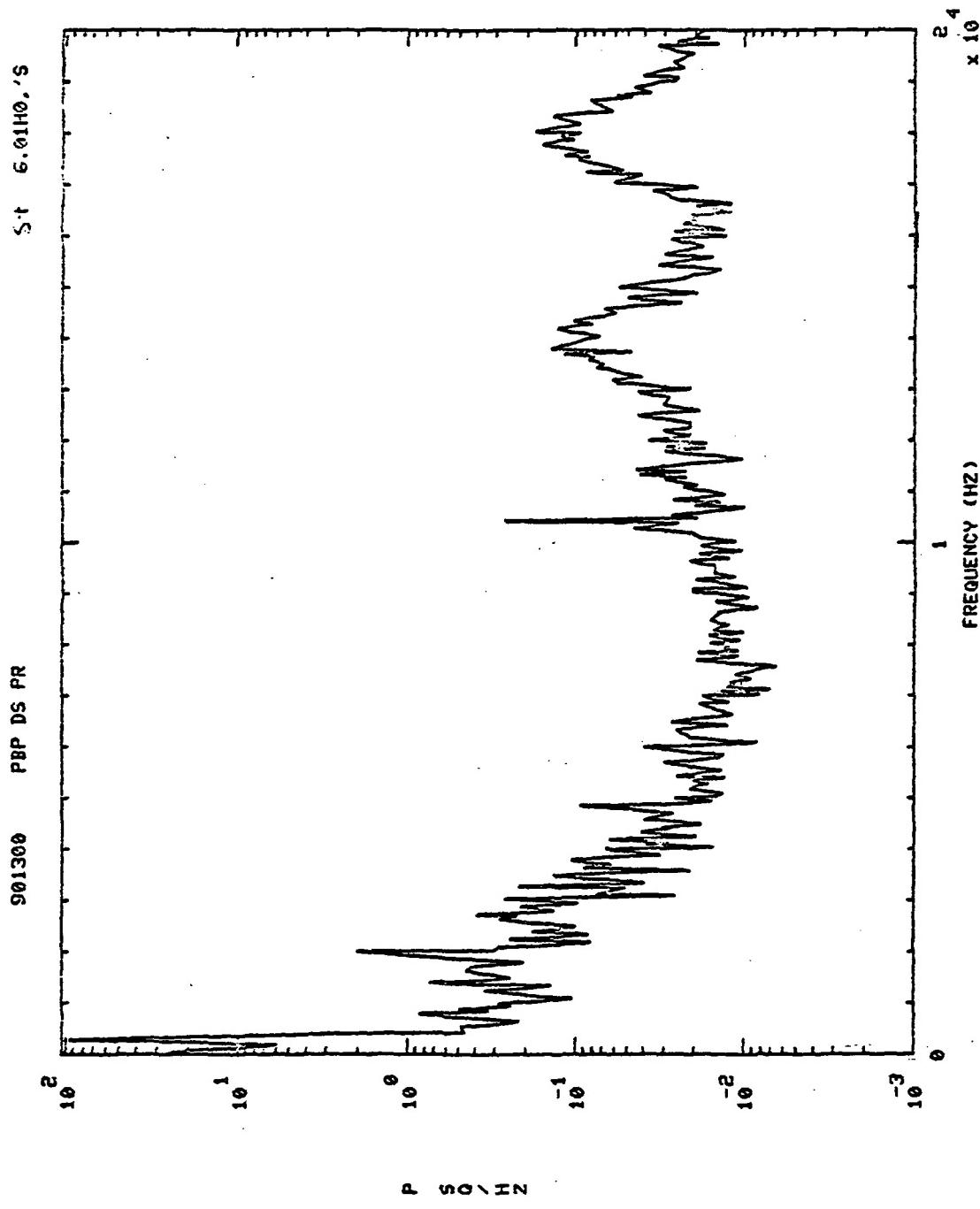


S01299 HPOP IN PR S+ 6.01H0.'S



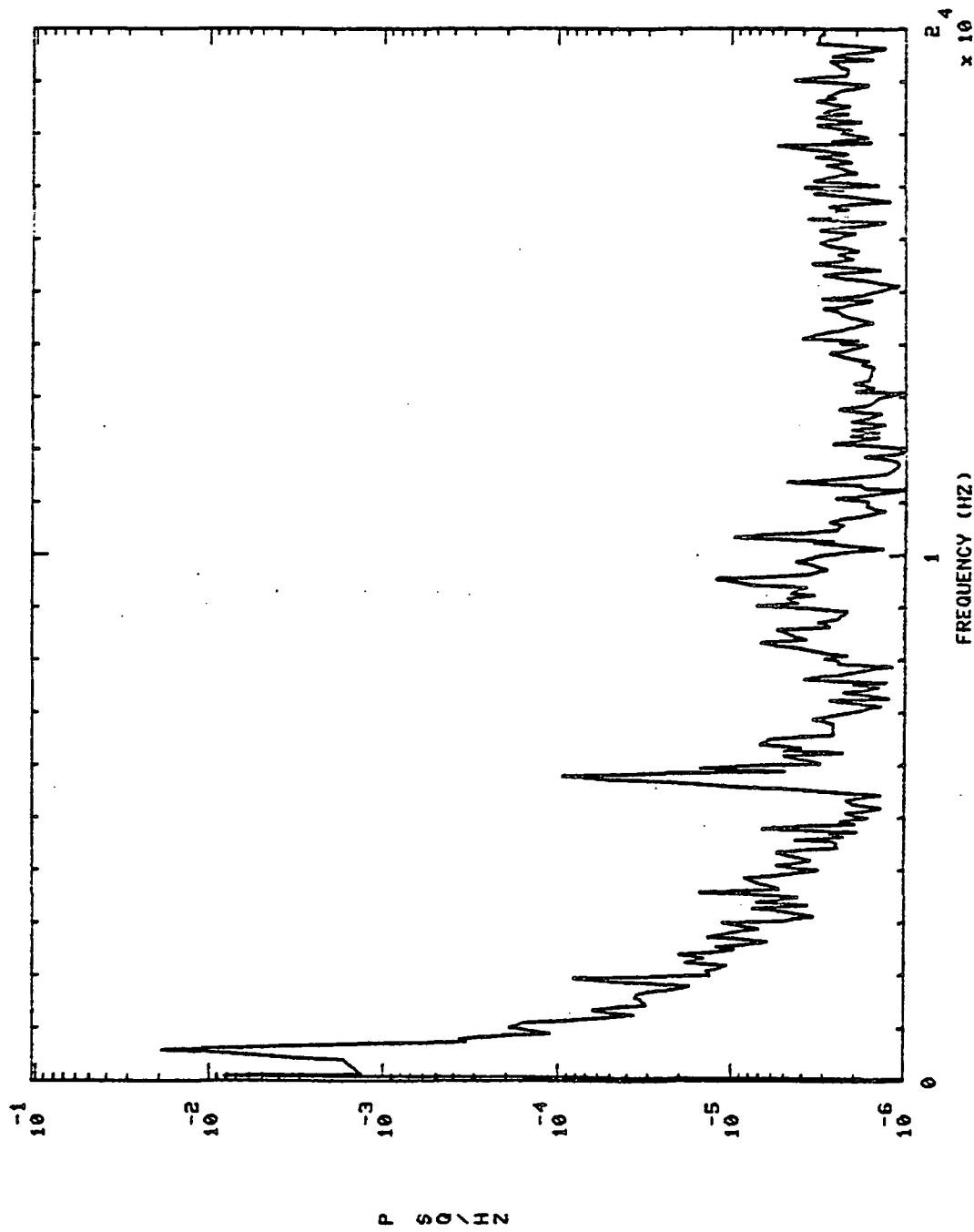






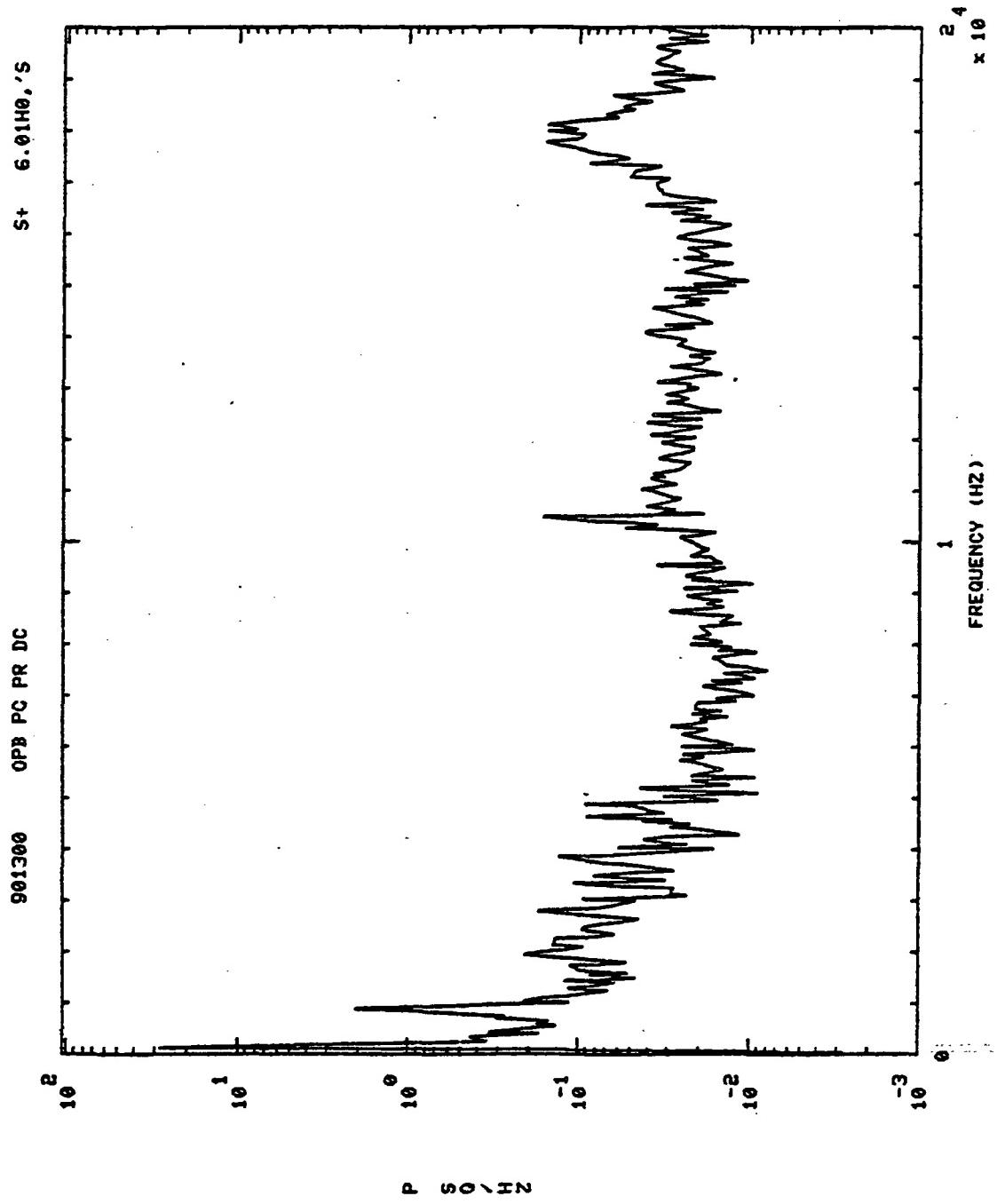
S: 6.01H0, '5

961300 HPOP IN PR



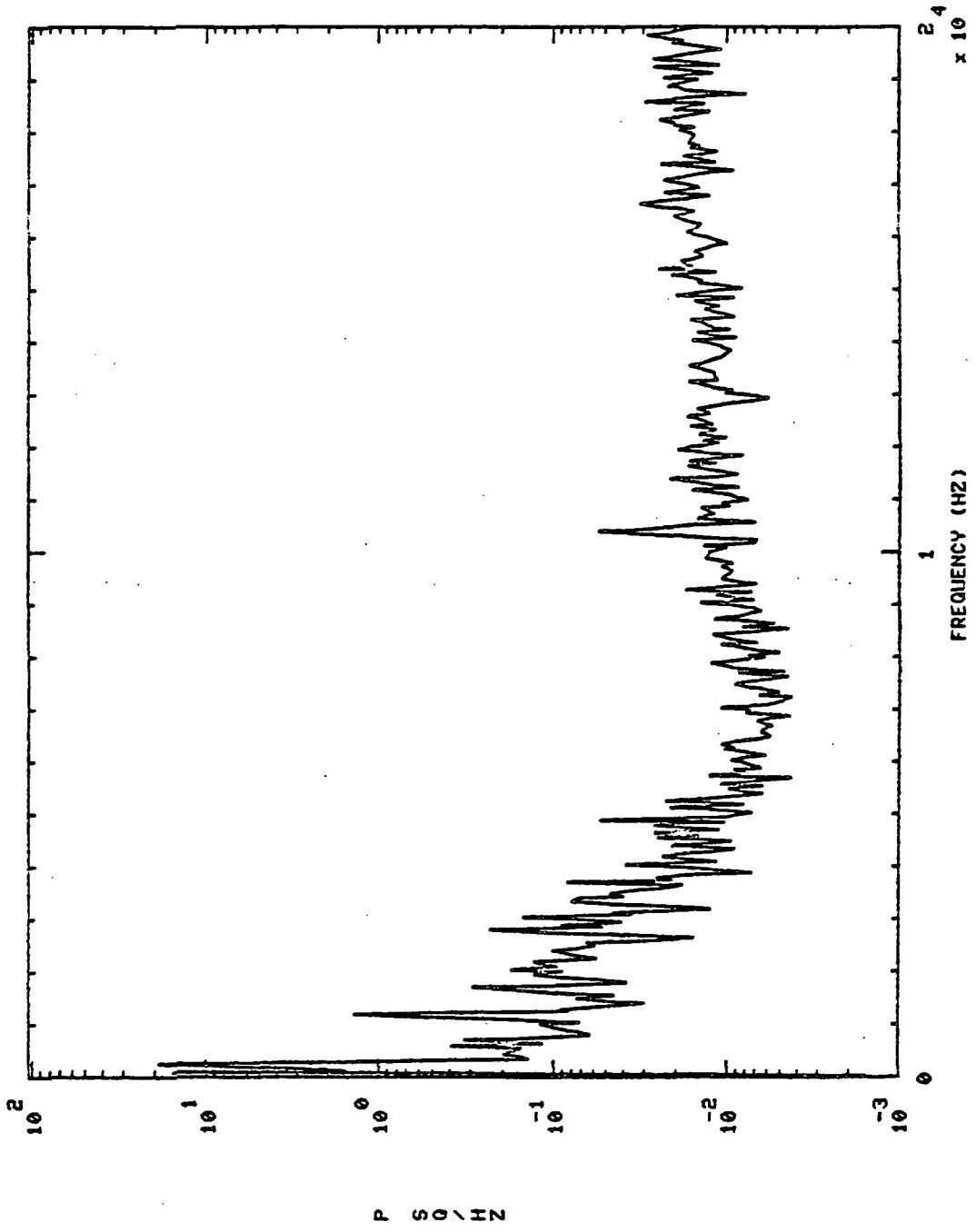
P S D / HZ

C.2

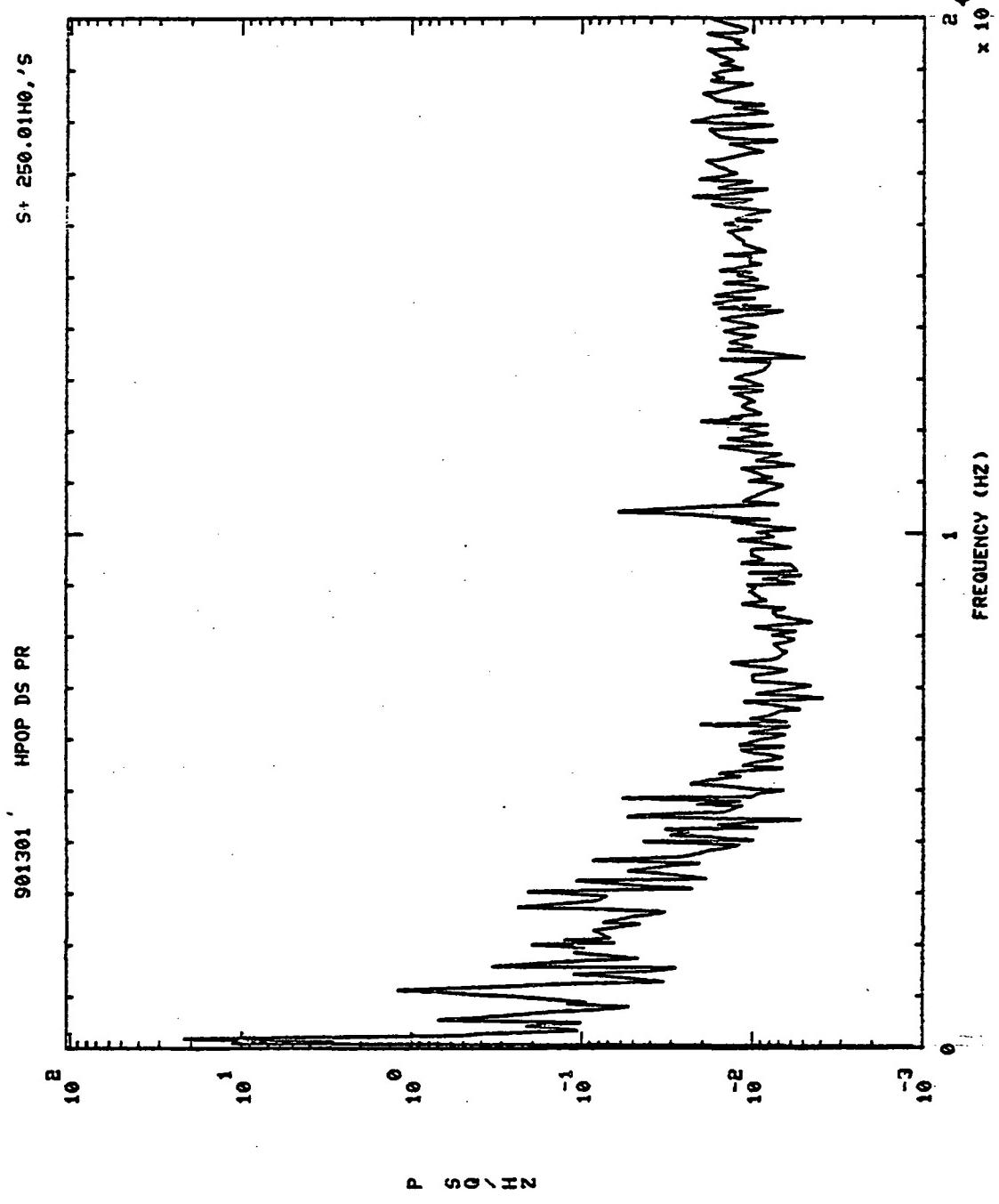


901301 HP0P DS PR

S+ 100.01H0, 'S

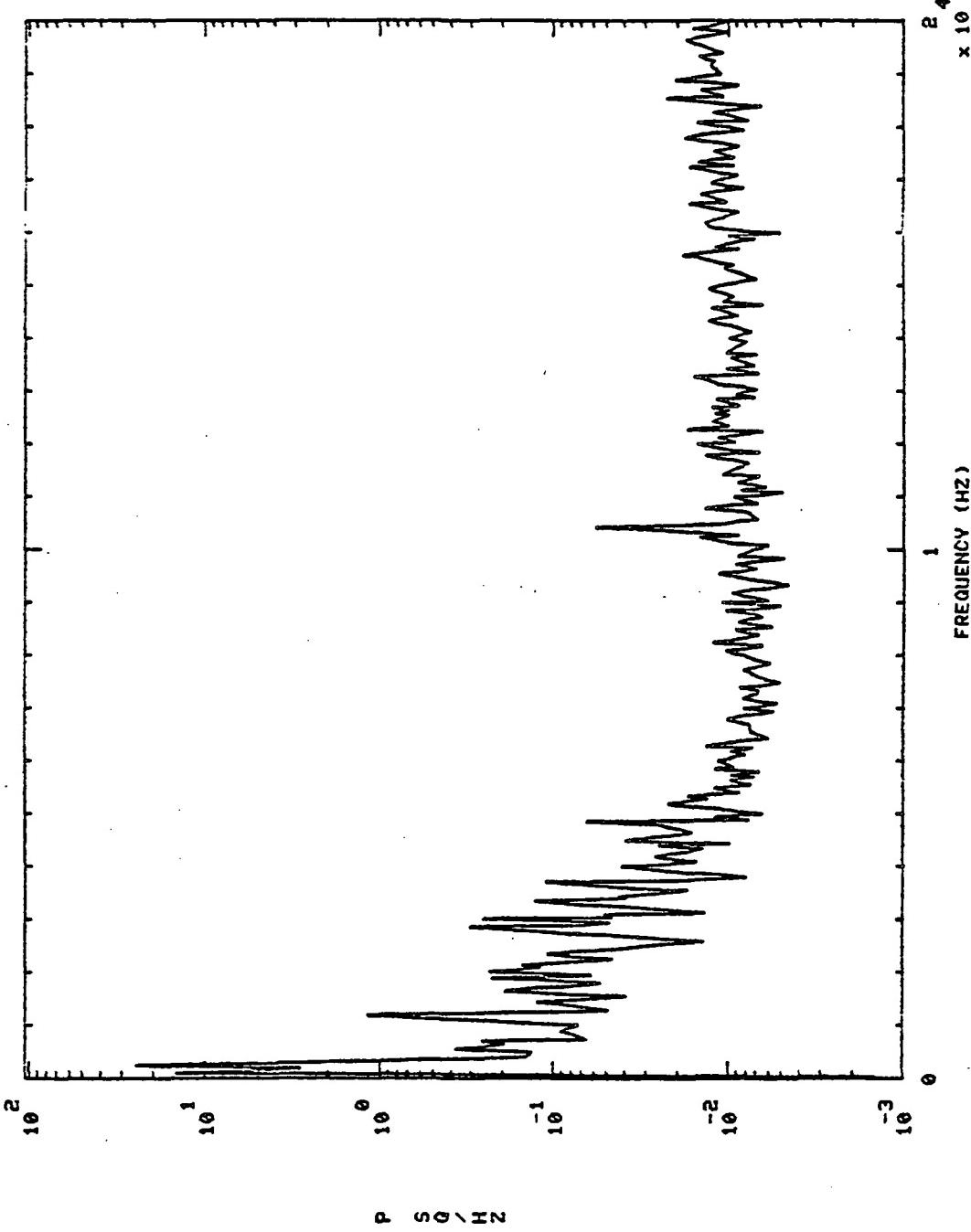


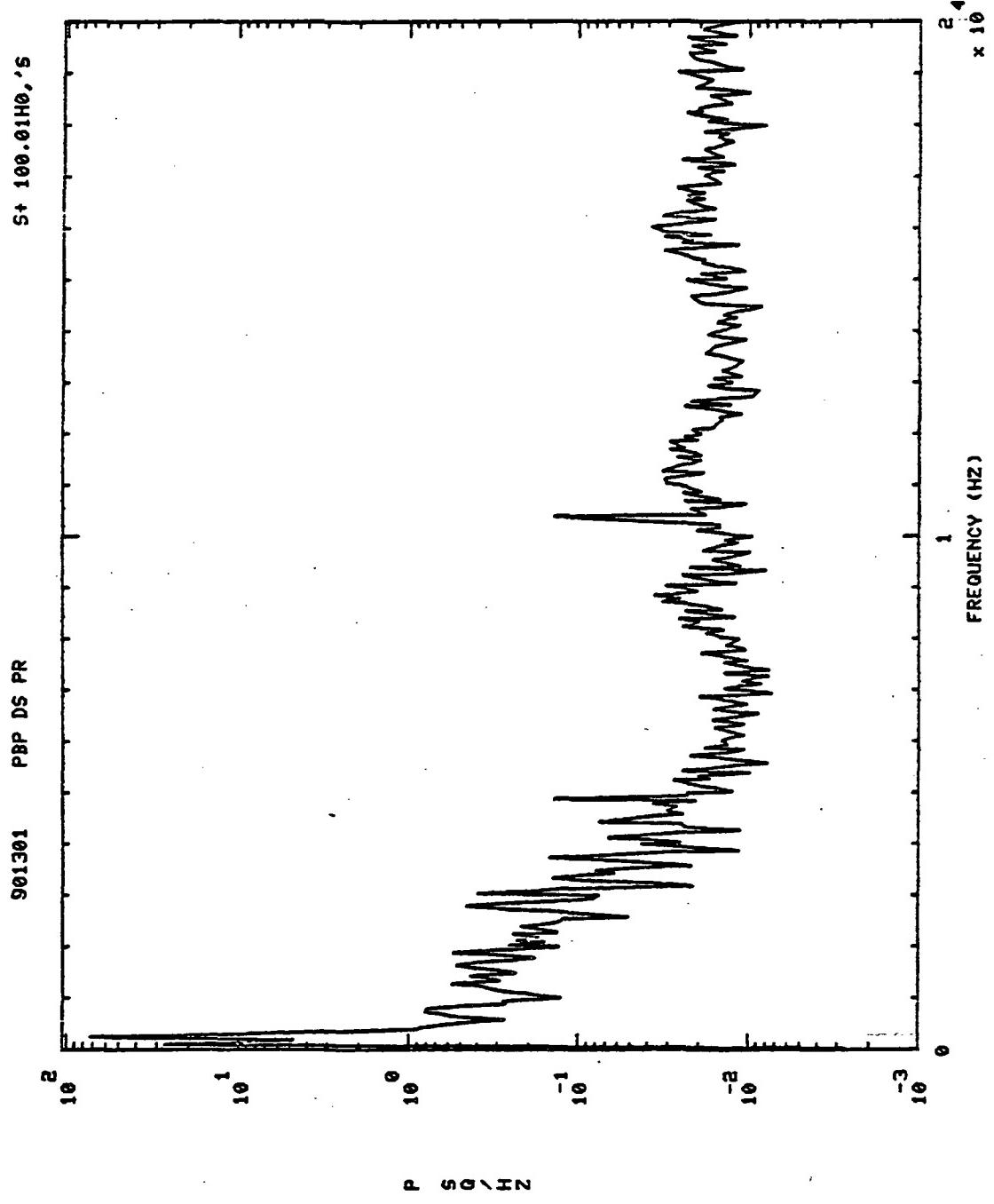
P S G / Hz



S+ 400.01H0.'S

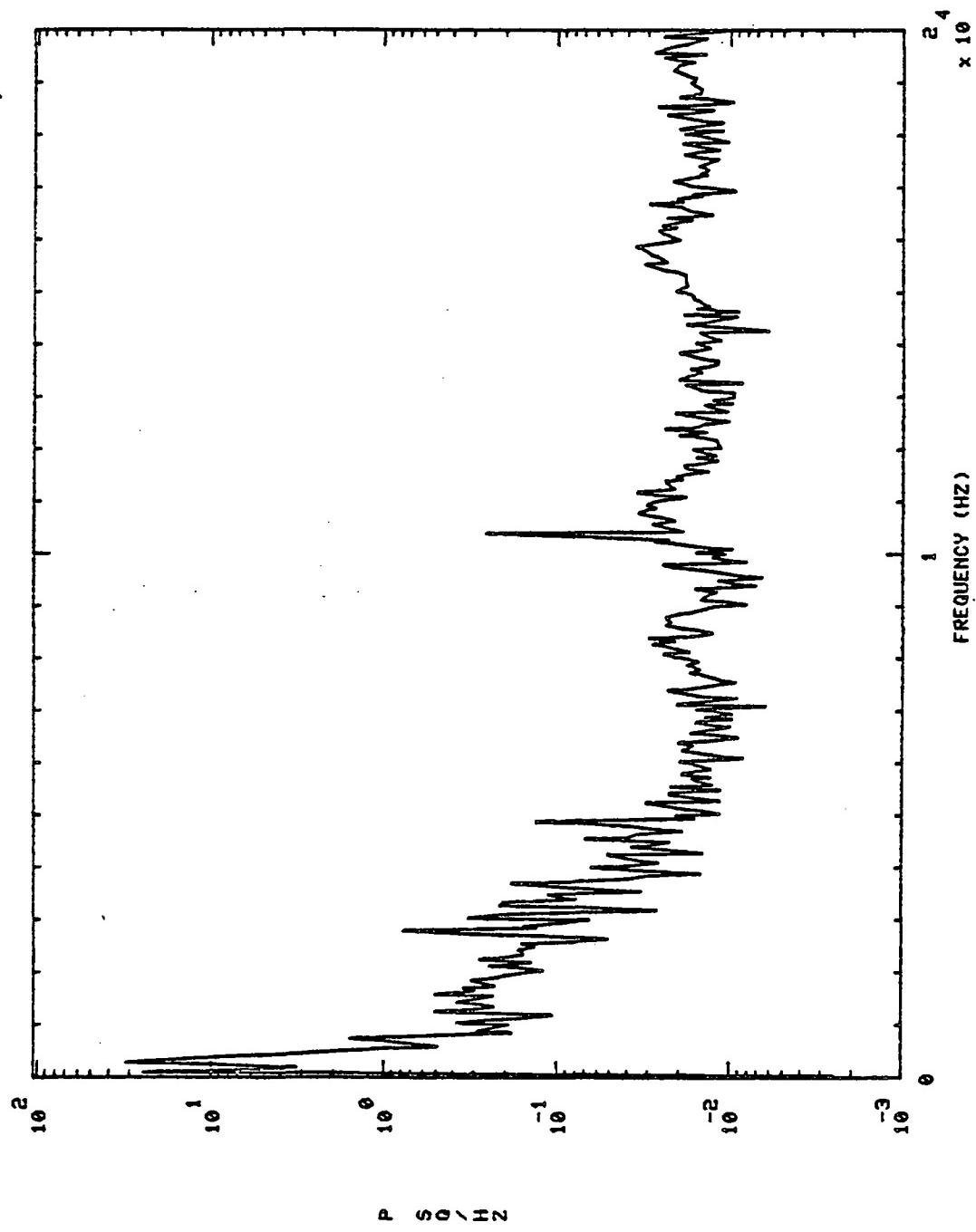
901301 HPOP DS PR

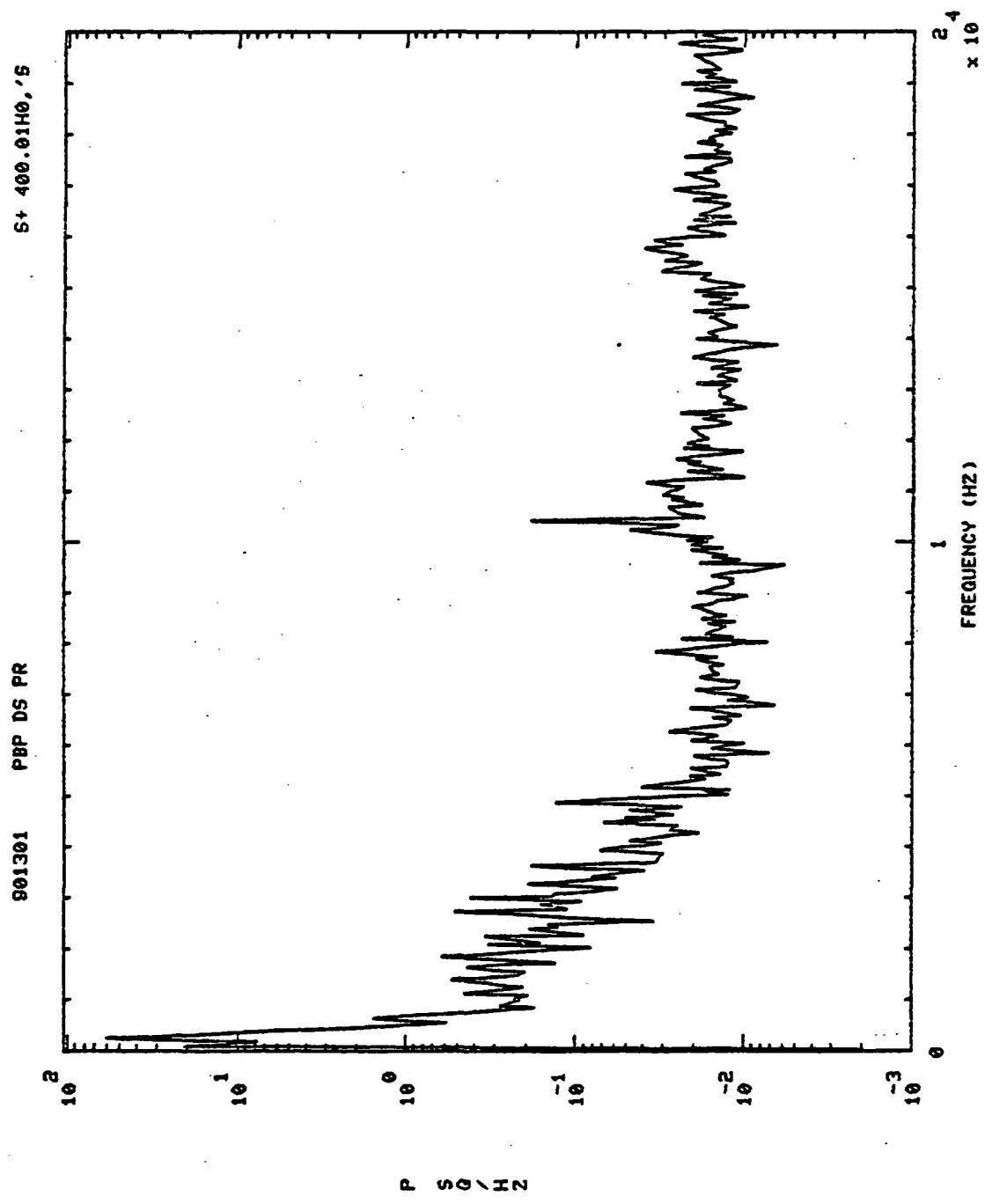




S+ 250.0140, 5

901301 PBP DS PR

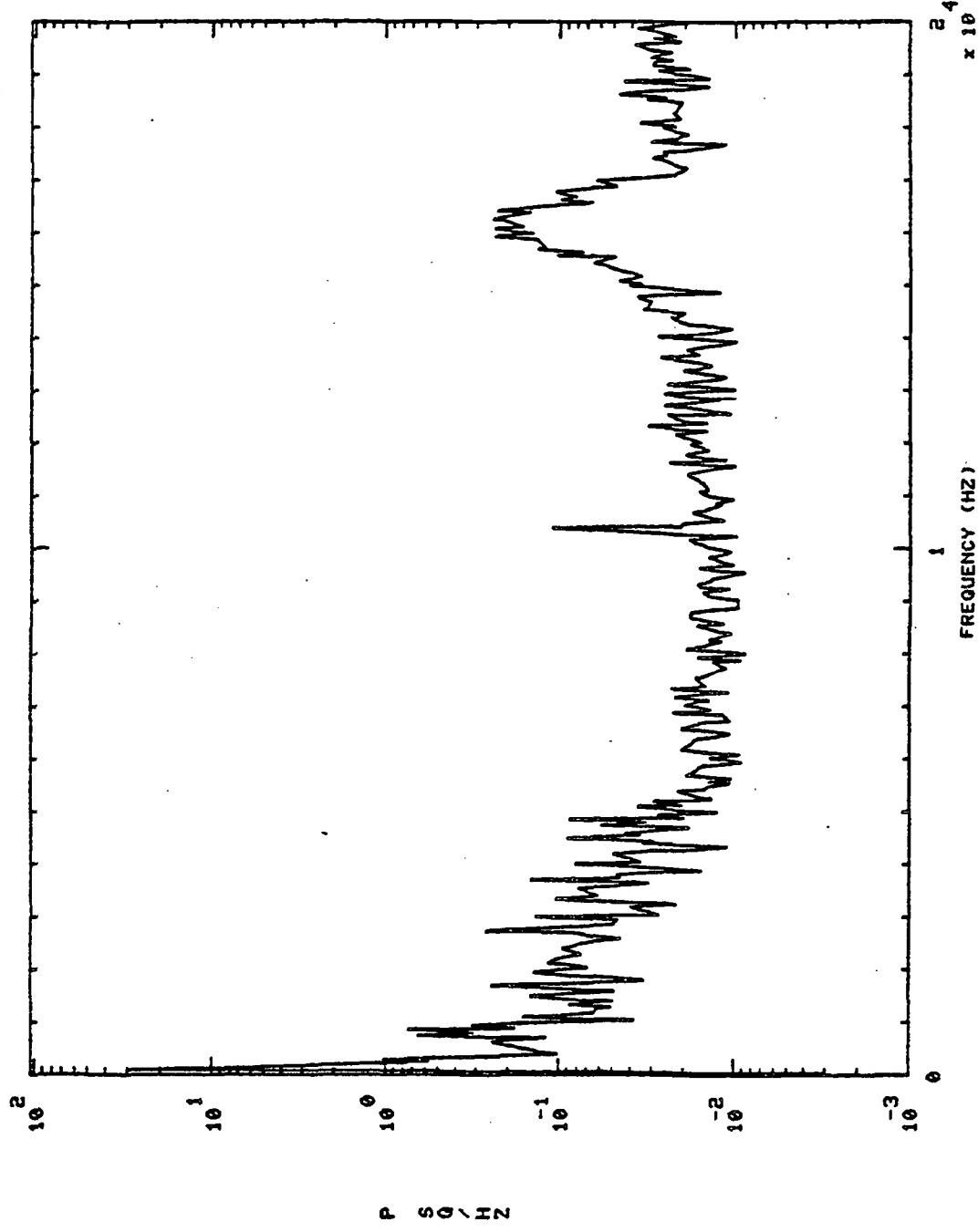




$S + 100.01H_0, 'S$

OPB PC PR DC

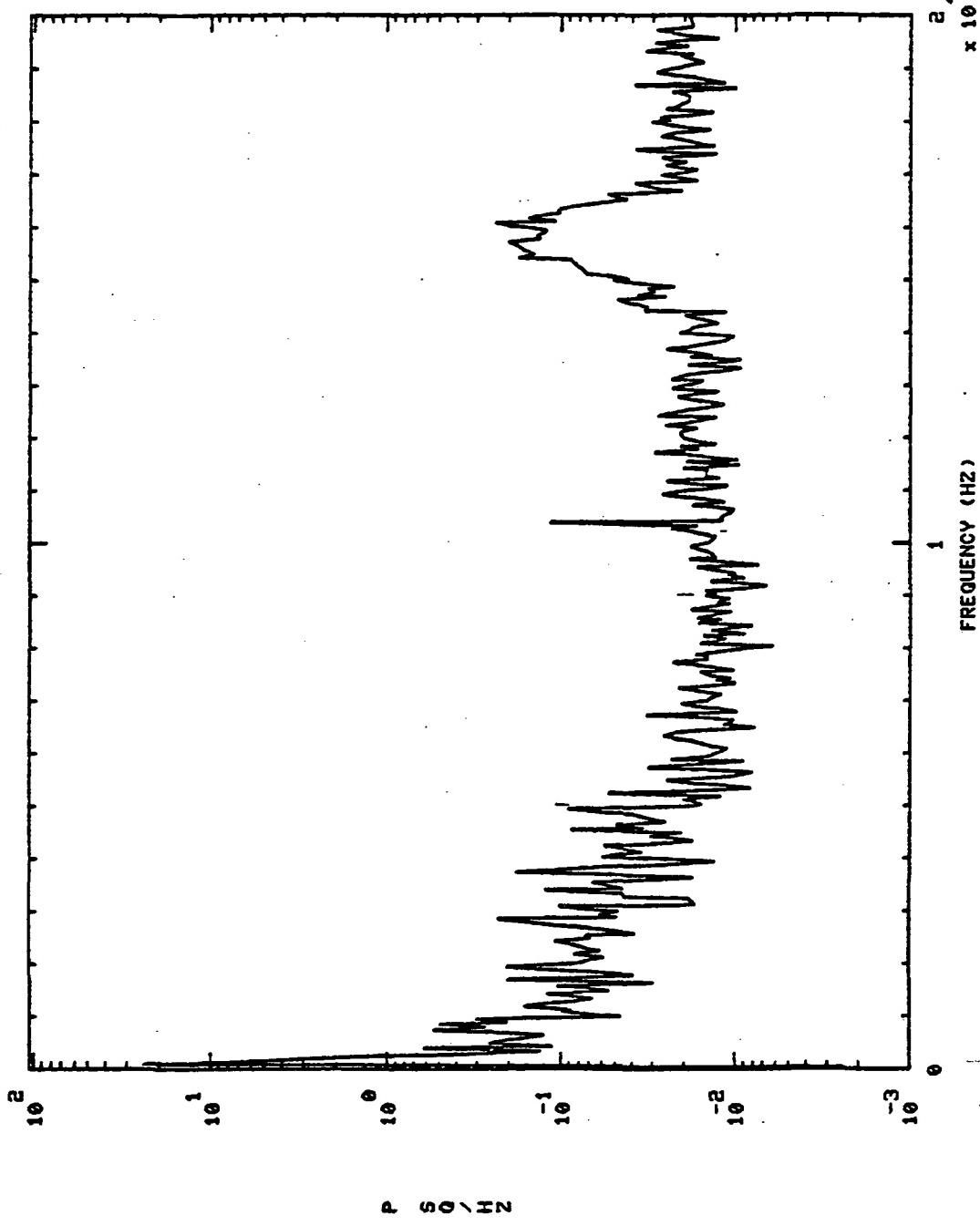
901301



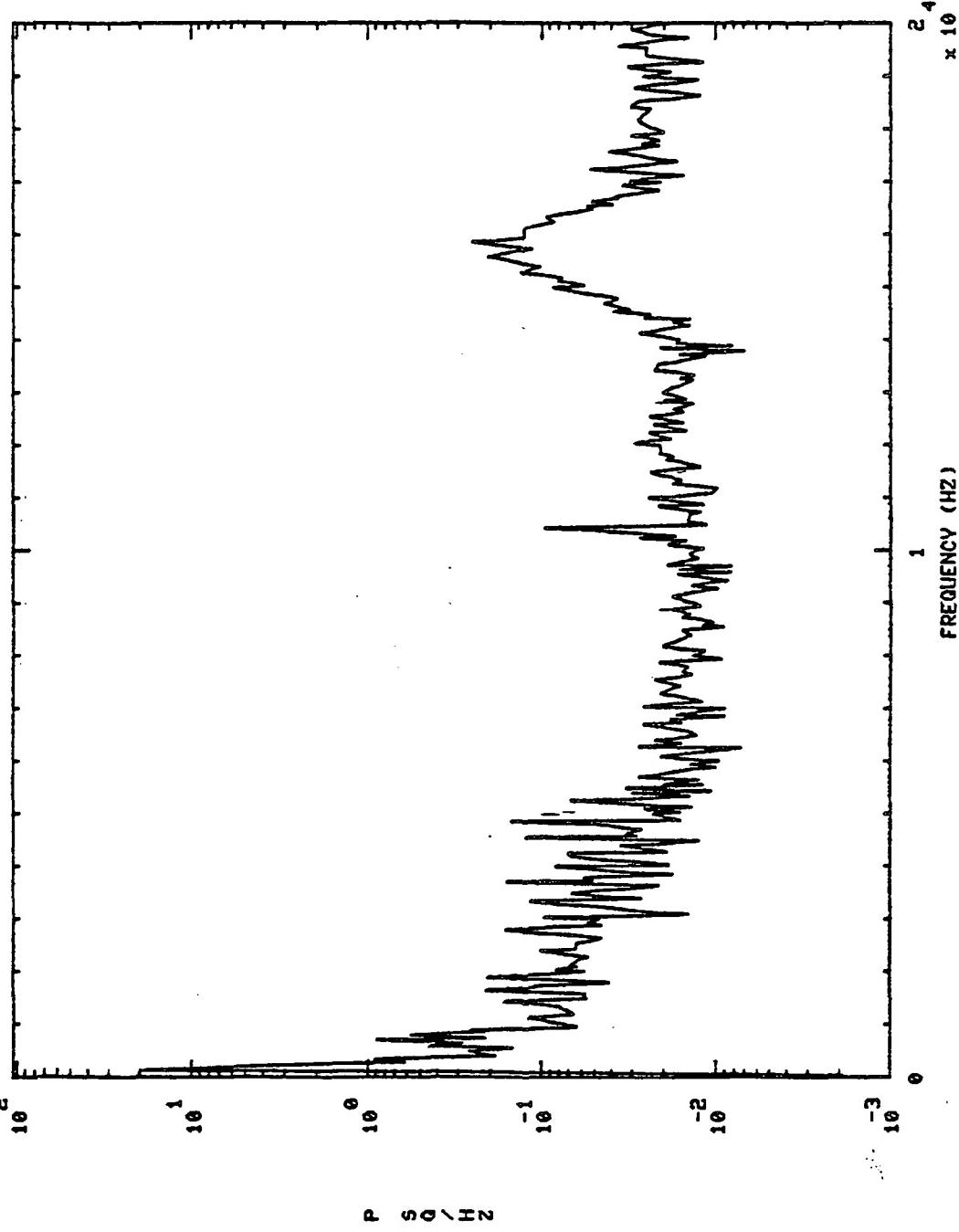
P S Q / HZ

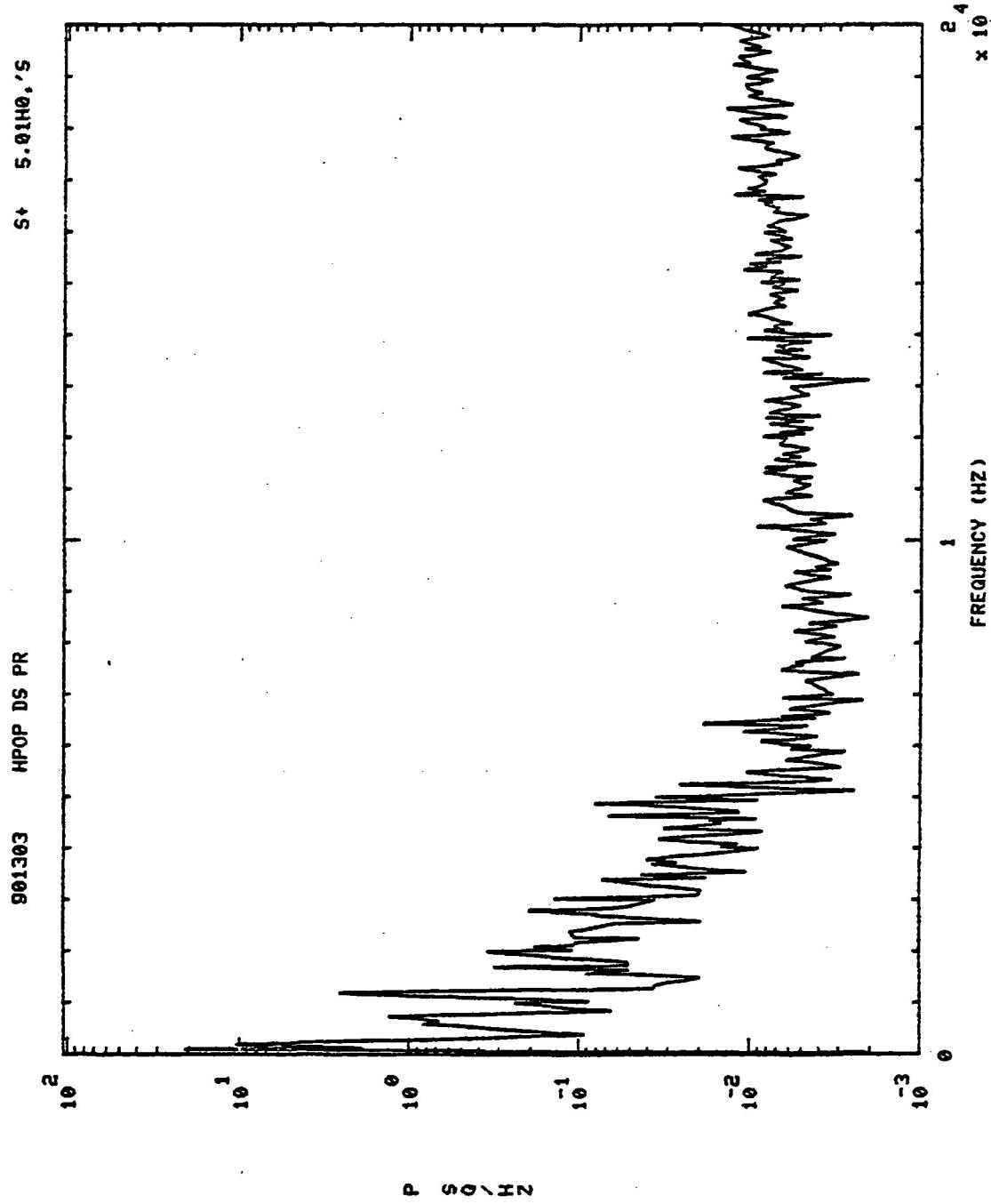
S+ 250.01H0.'S

901301 OPB PC PR DC



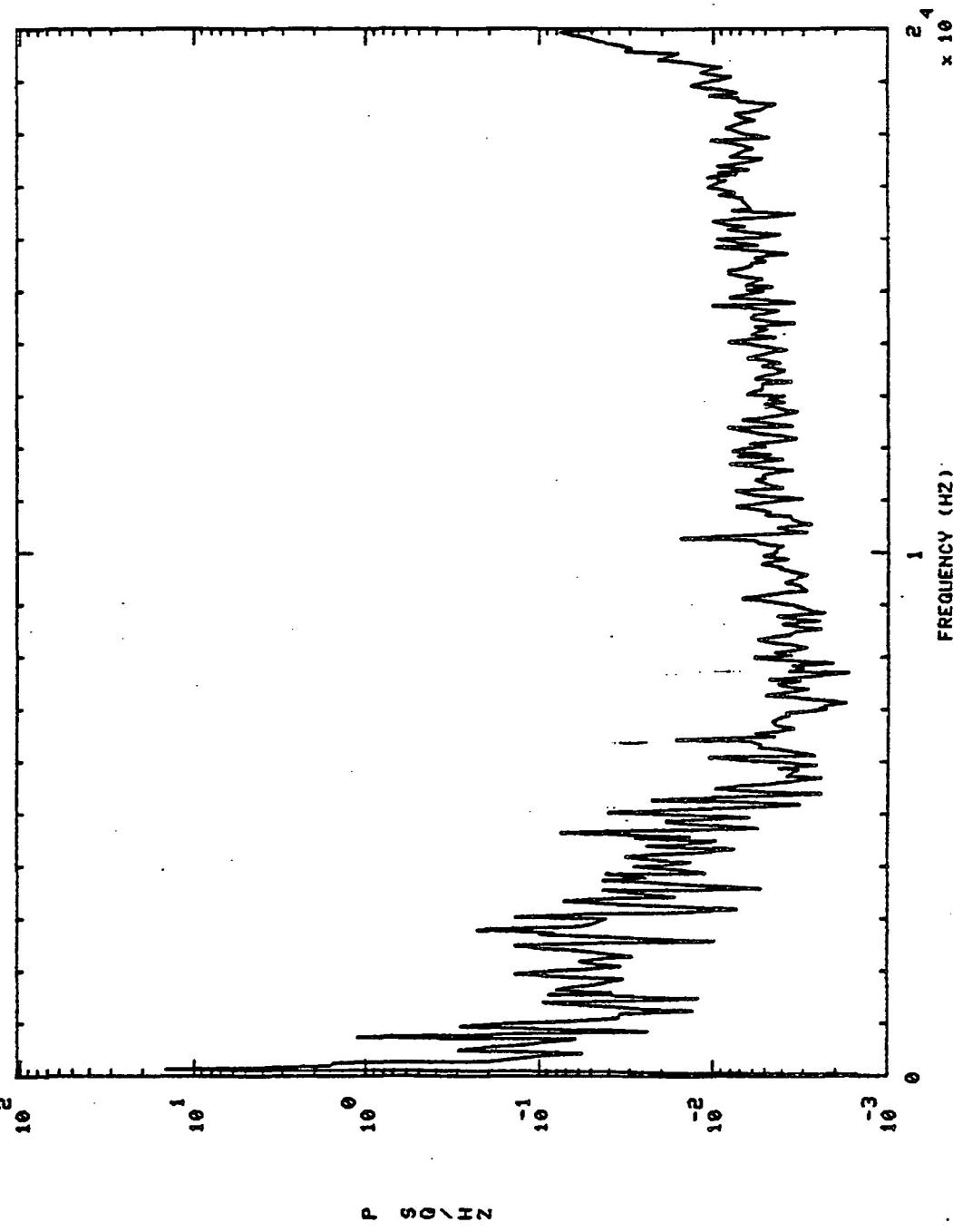
901301, OPB PC PR DC
S+ 100.01H0./S

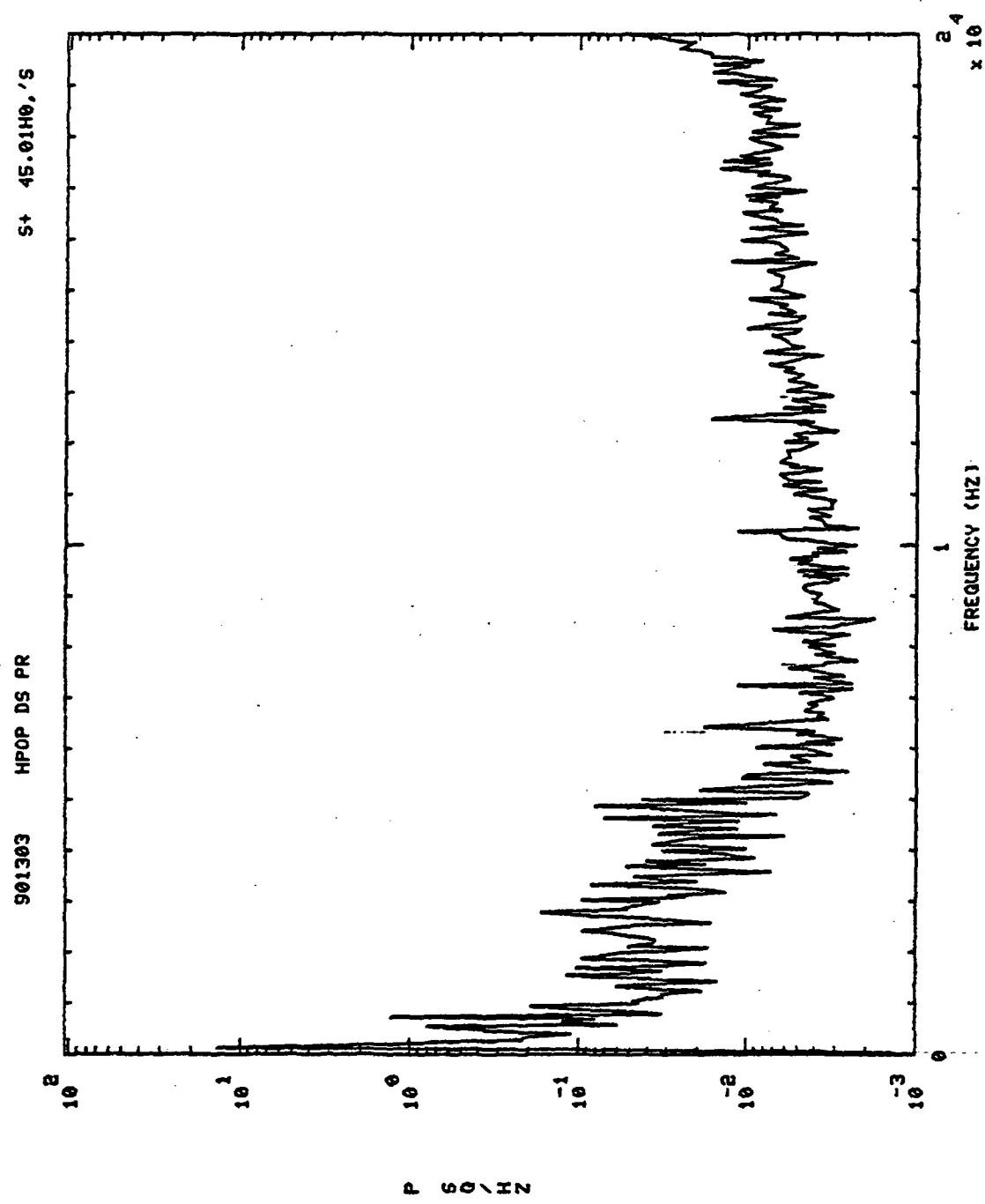




S+ 30.01H0, 'S

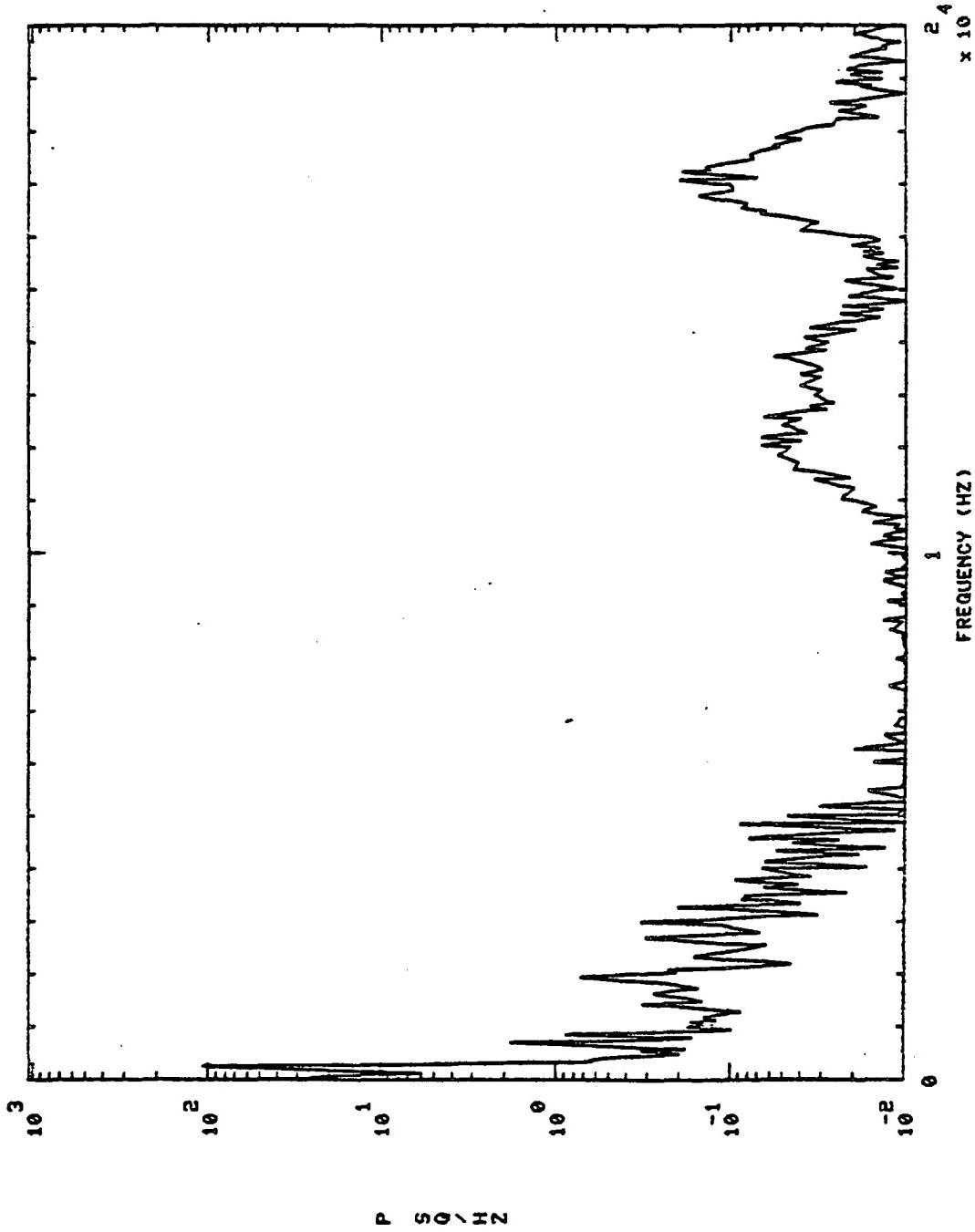
901363 HP0P DS PR

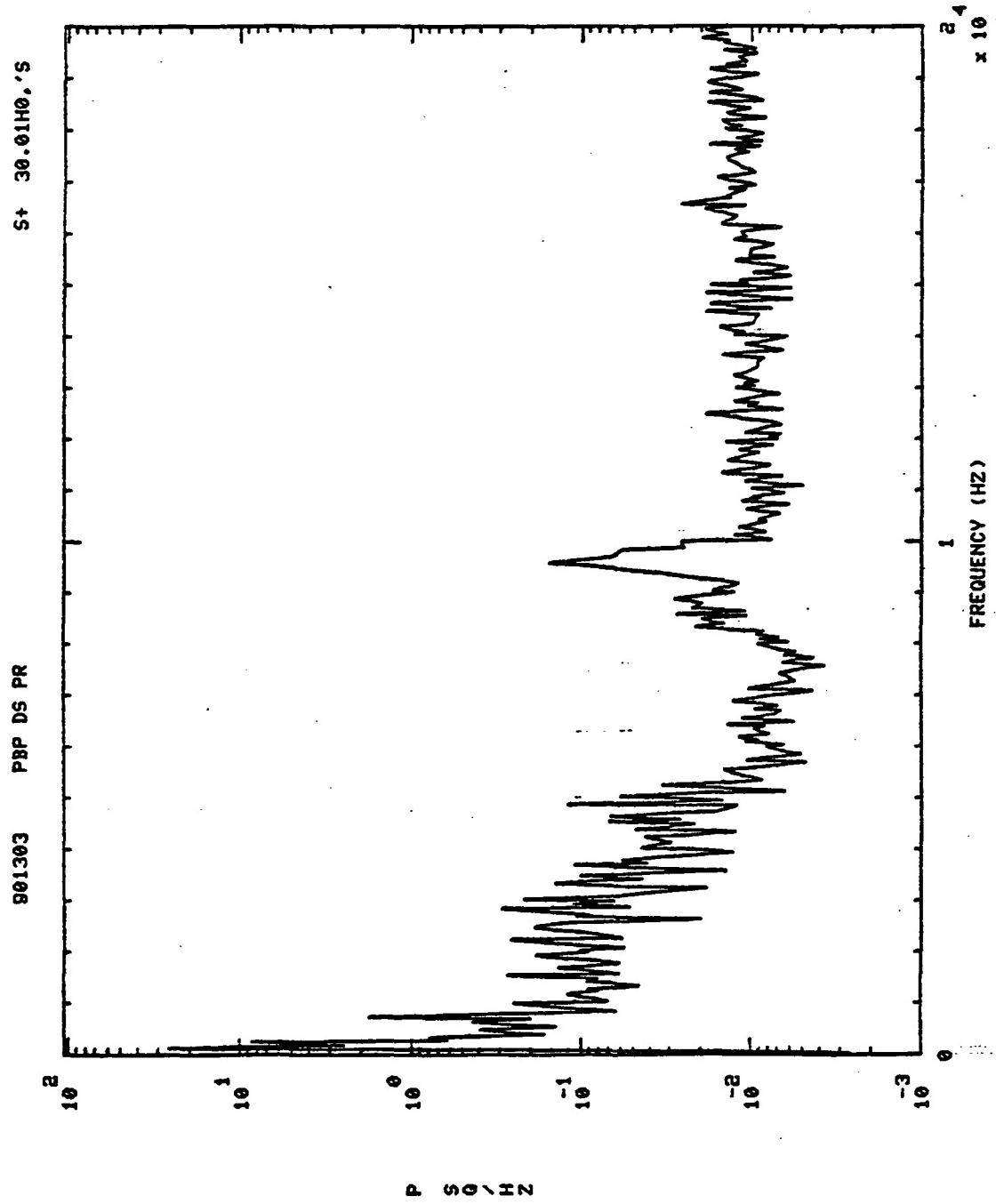


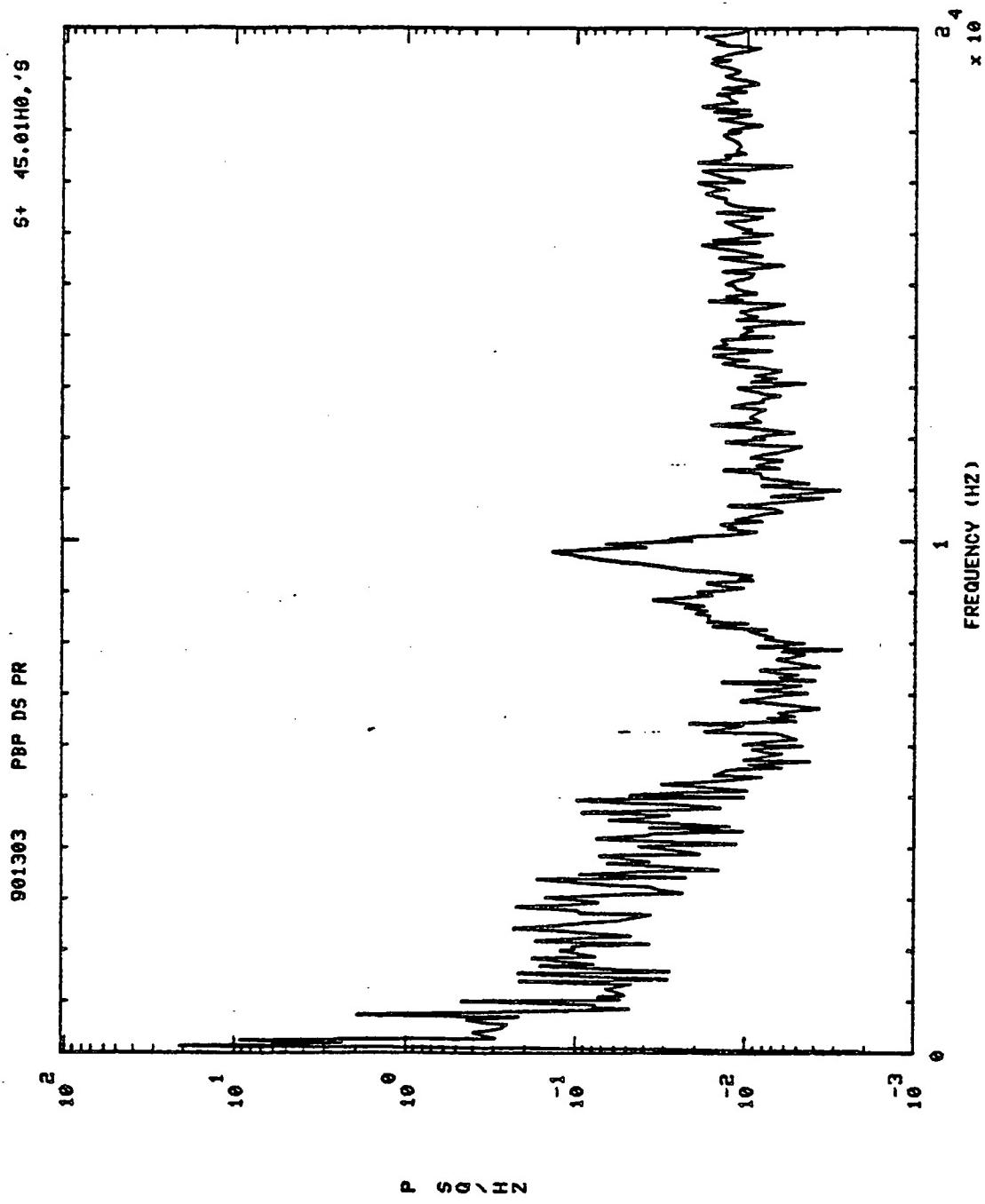


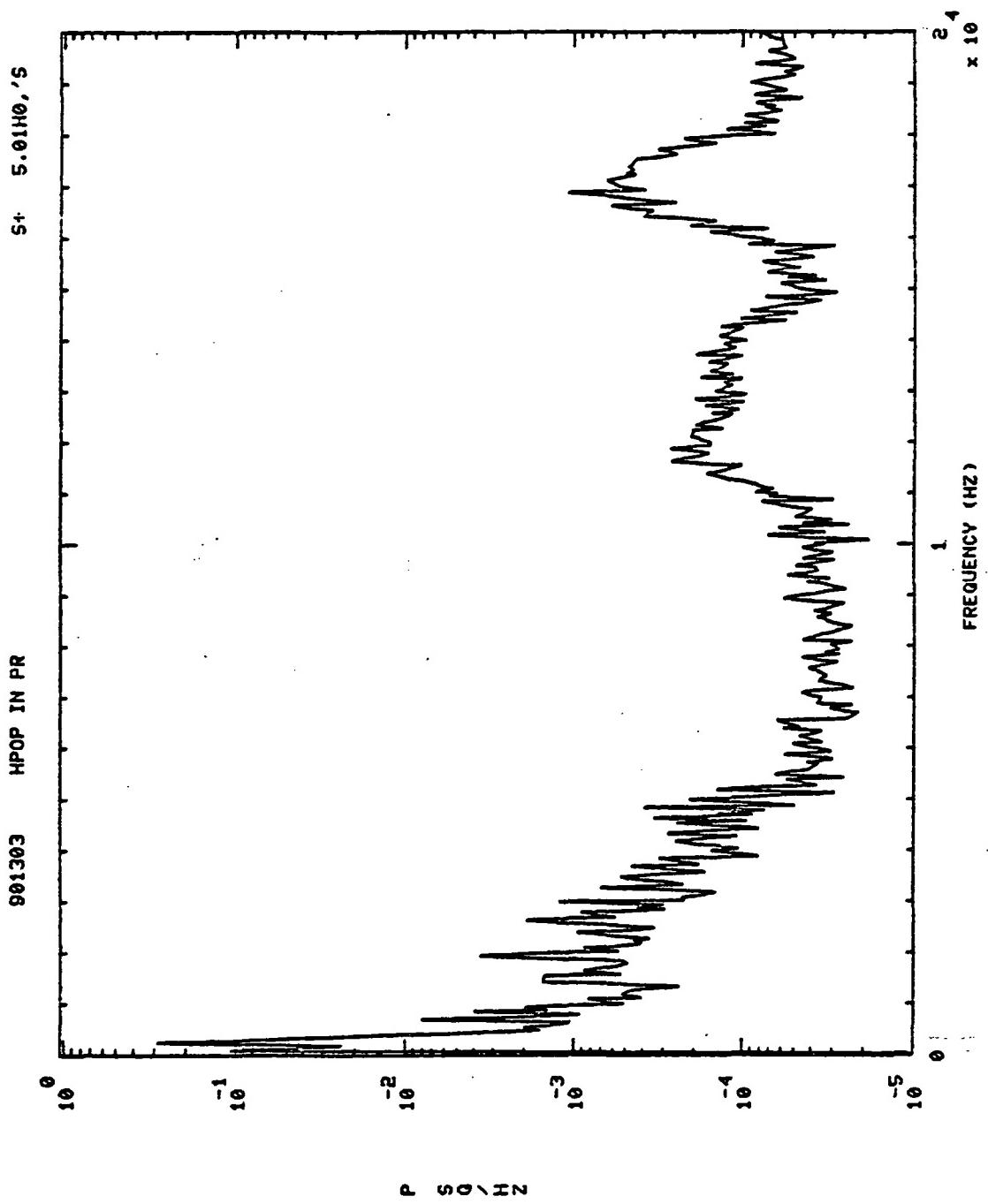
901303 PBP DS PR

S+ 5.0110, 'S



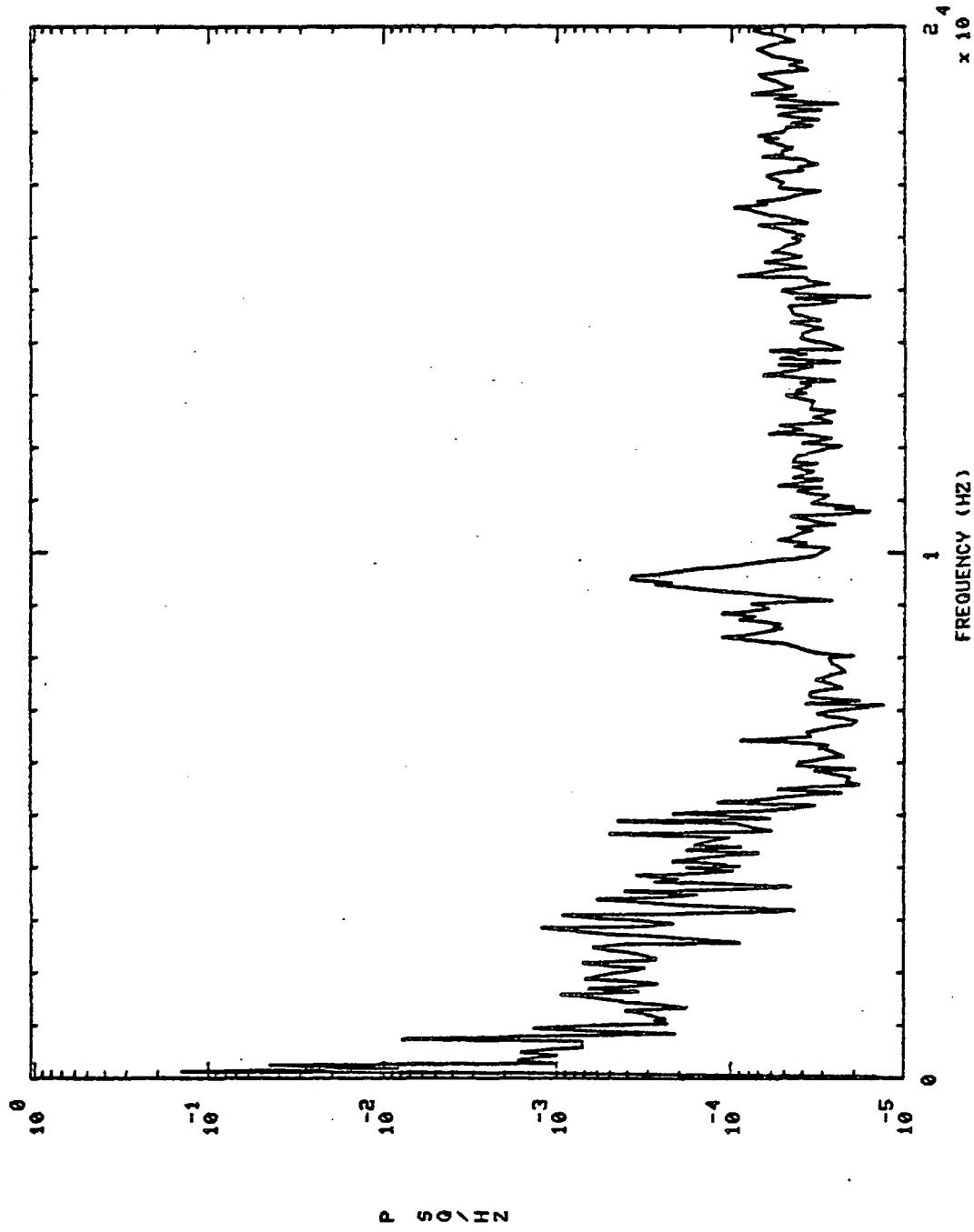


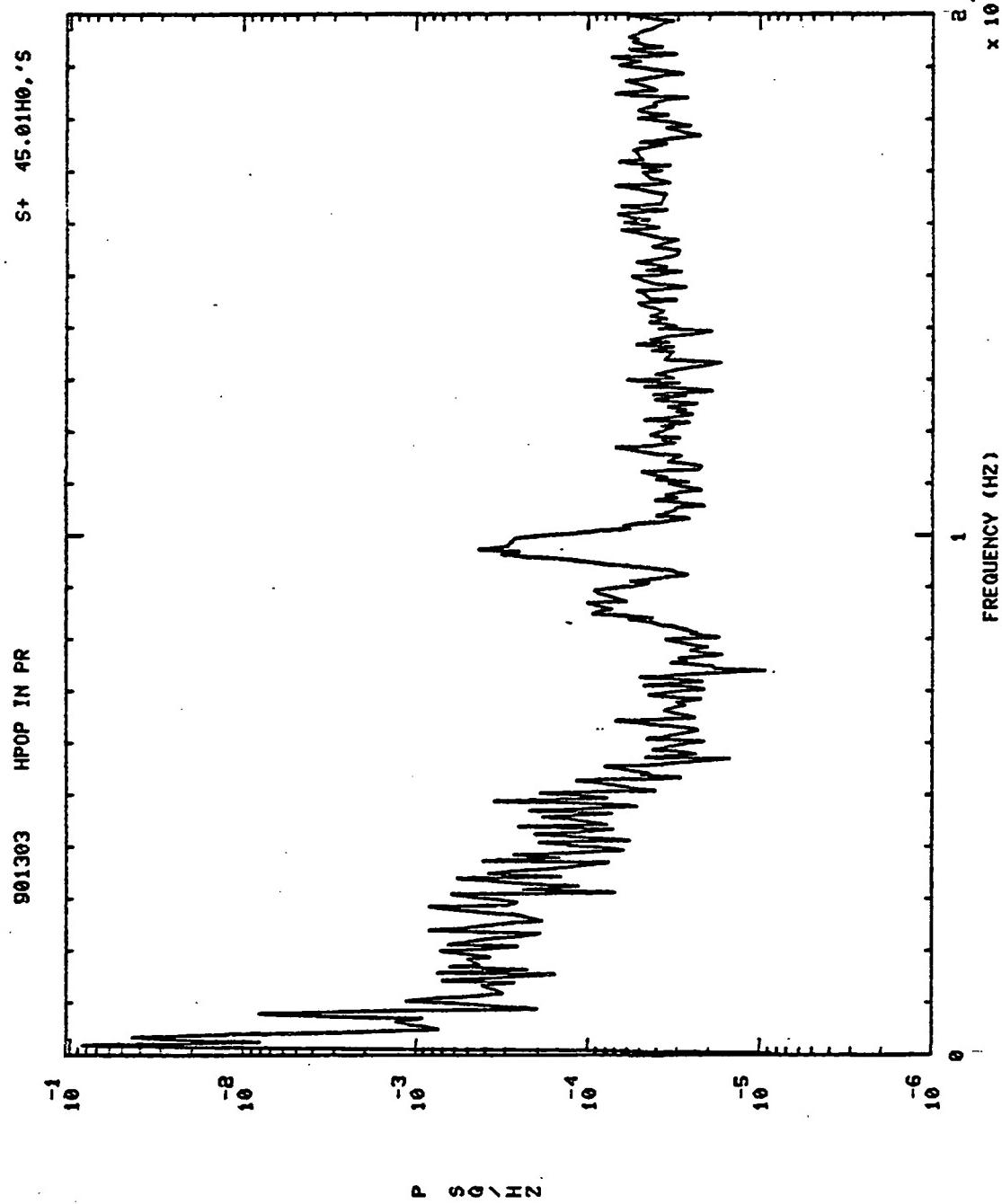




901303 HPOP IN PR

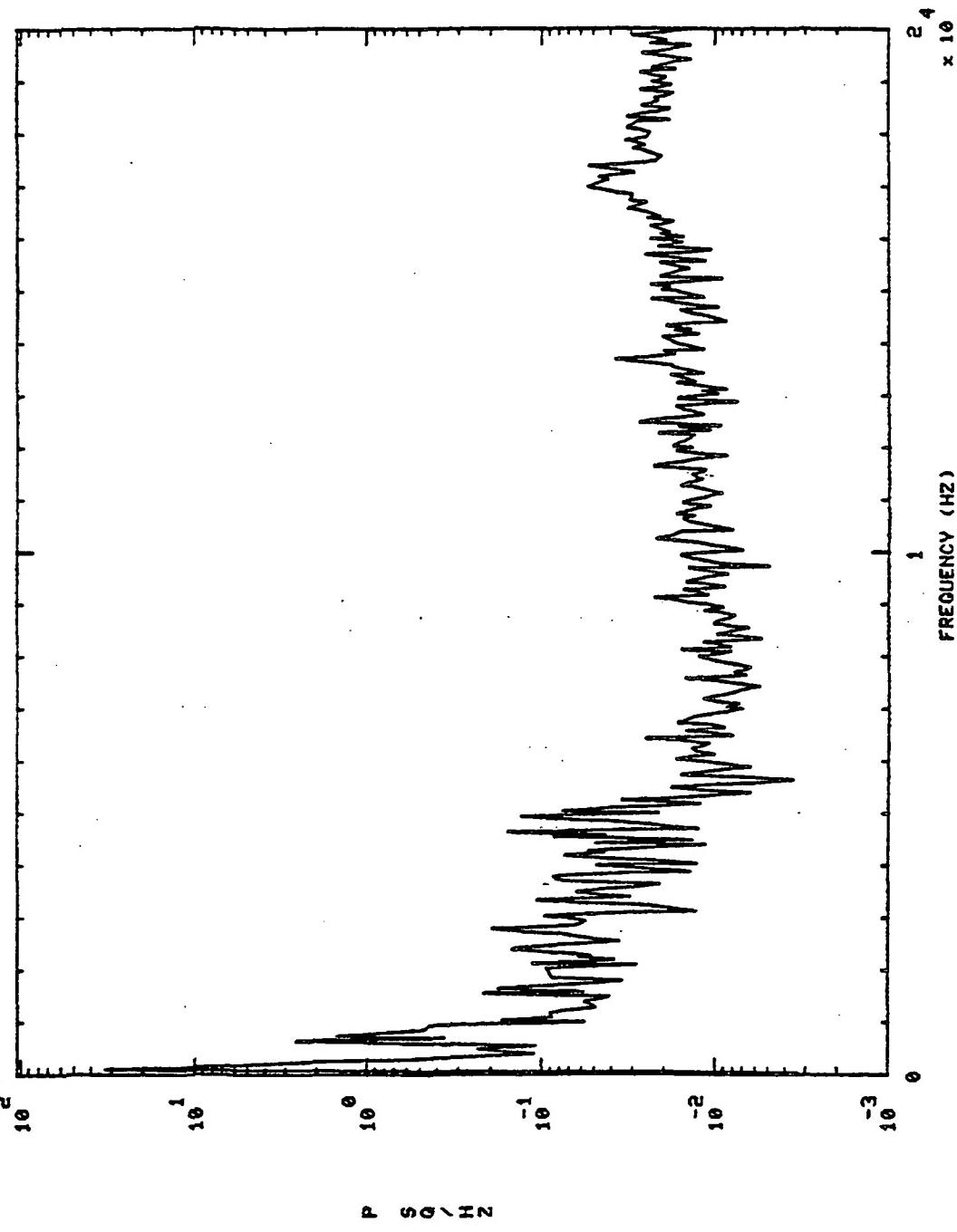
S+ 30.01H0.'S

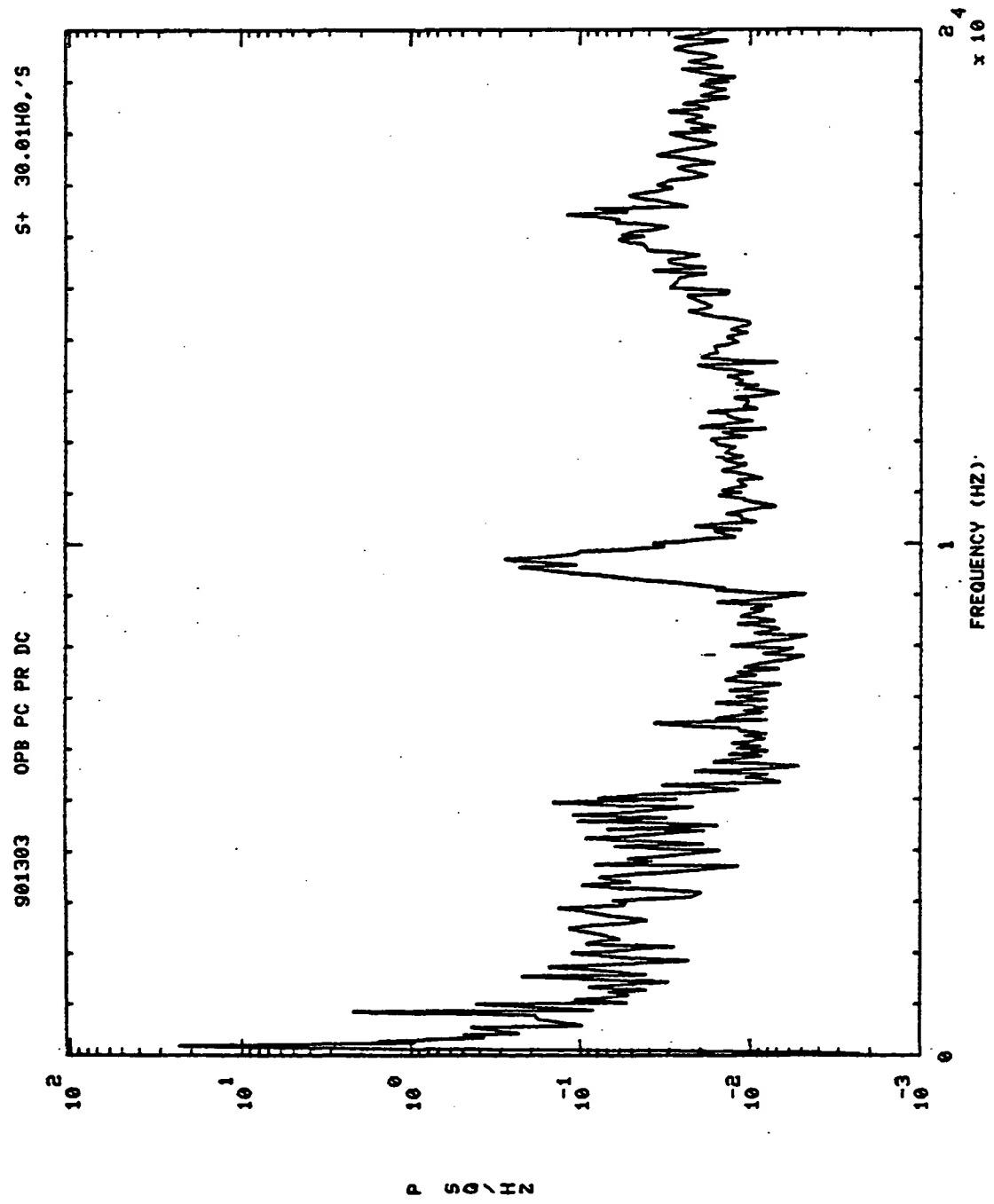




S+ 5.01H0, 'S

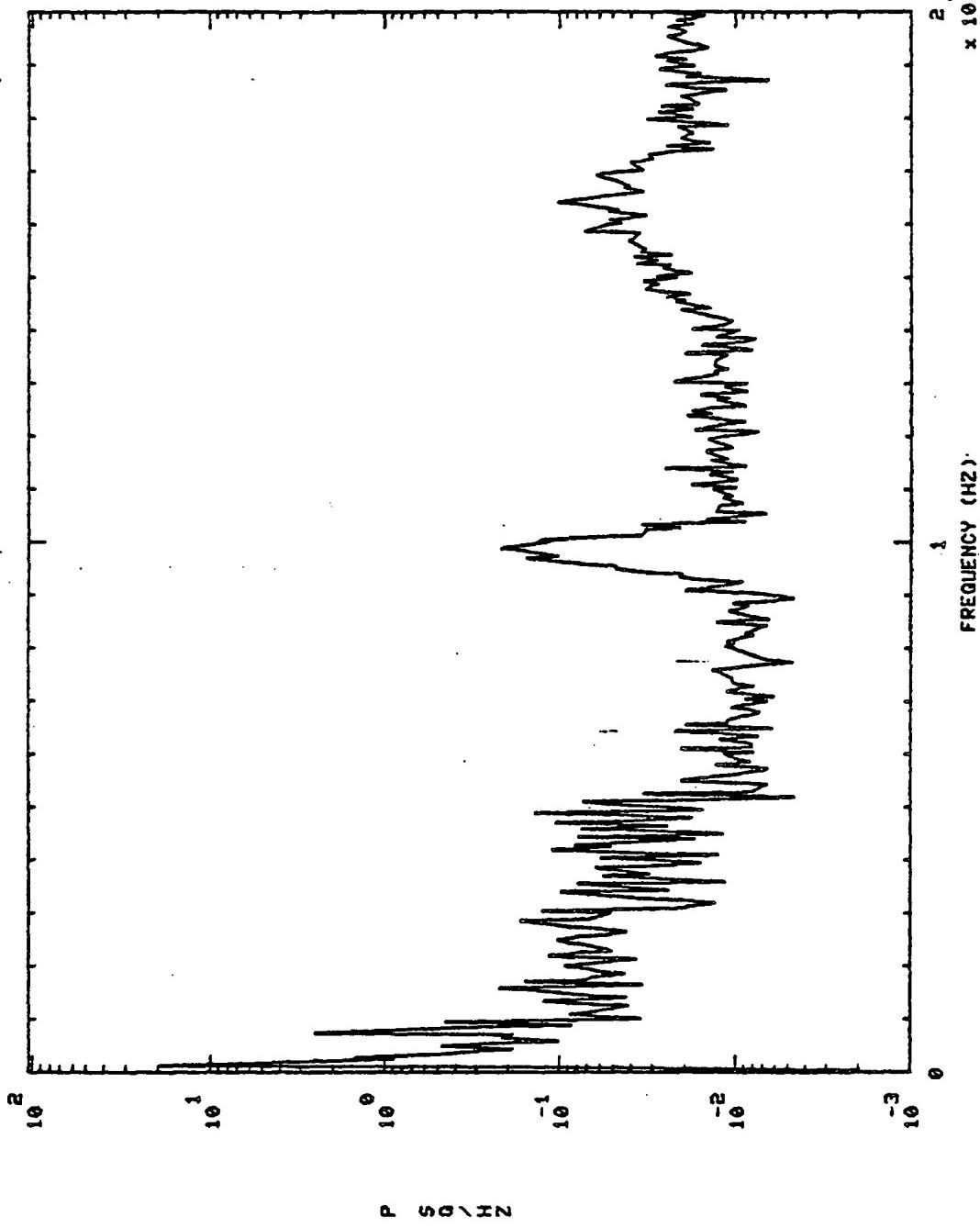
901303 OPB PC PR DC

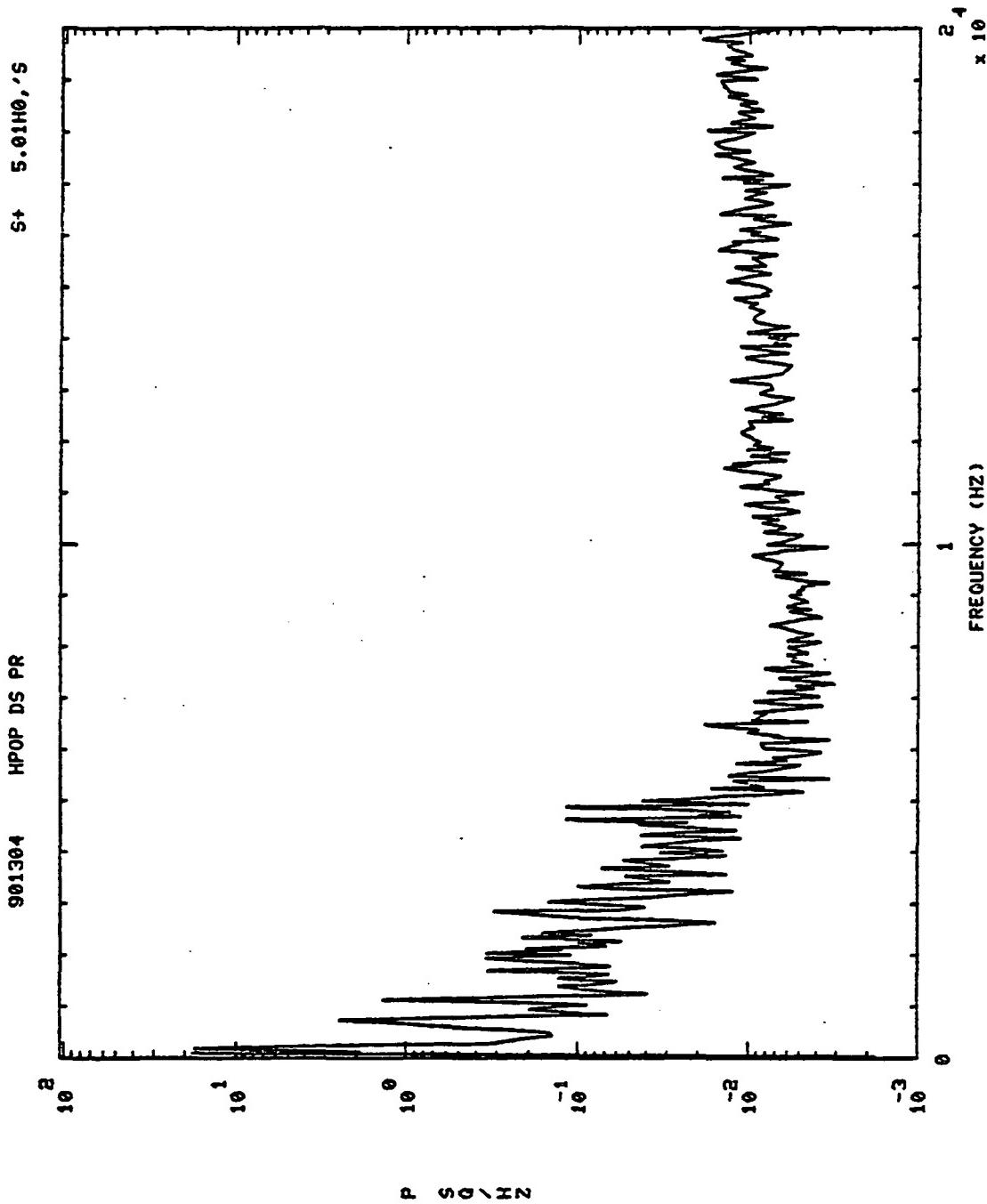




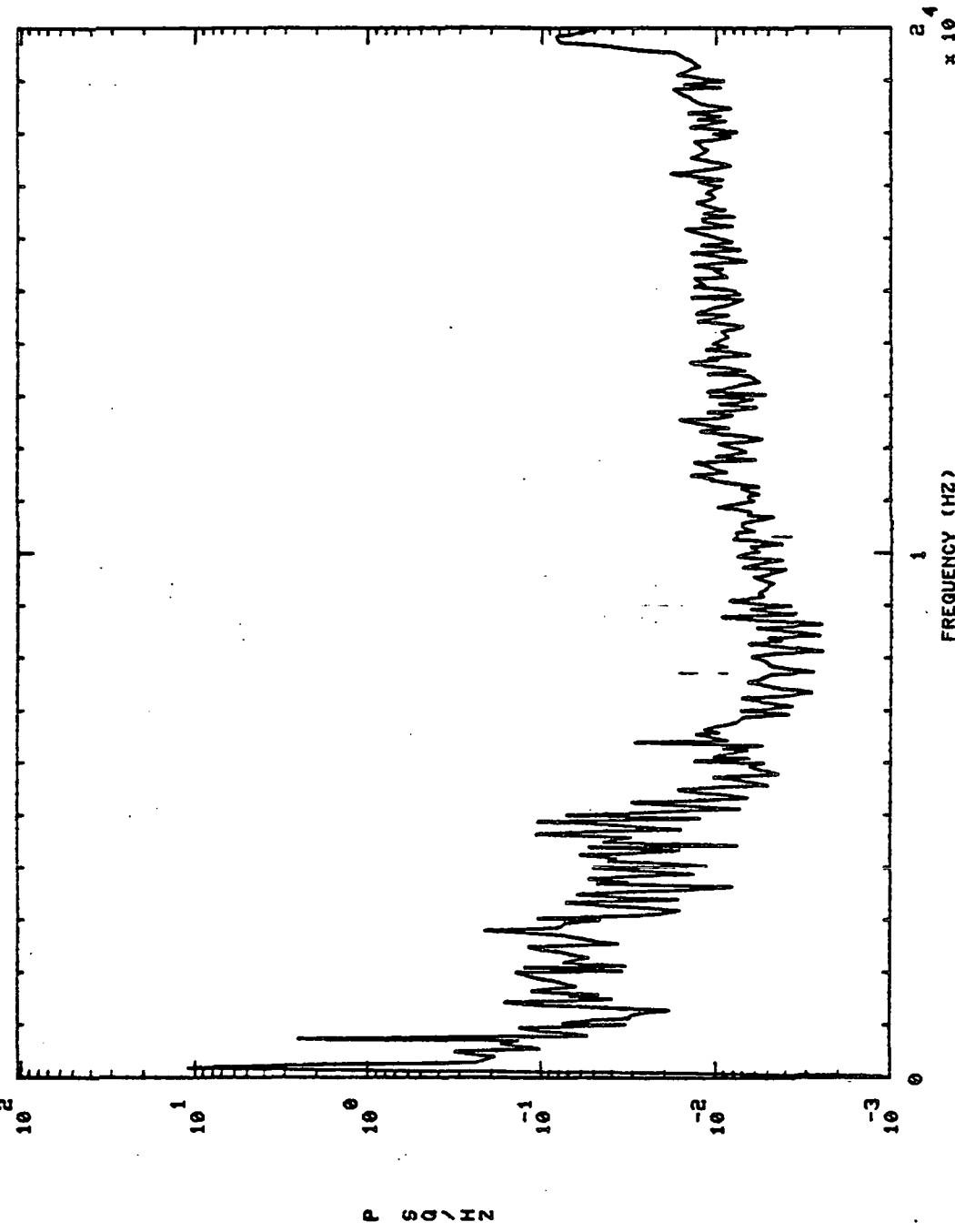
S+ 45.01H0; '5

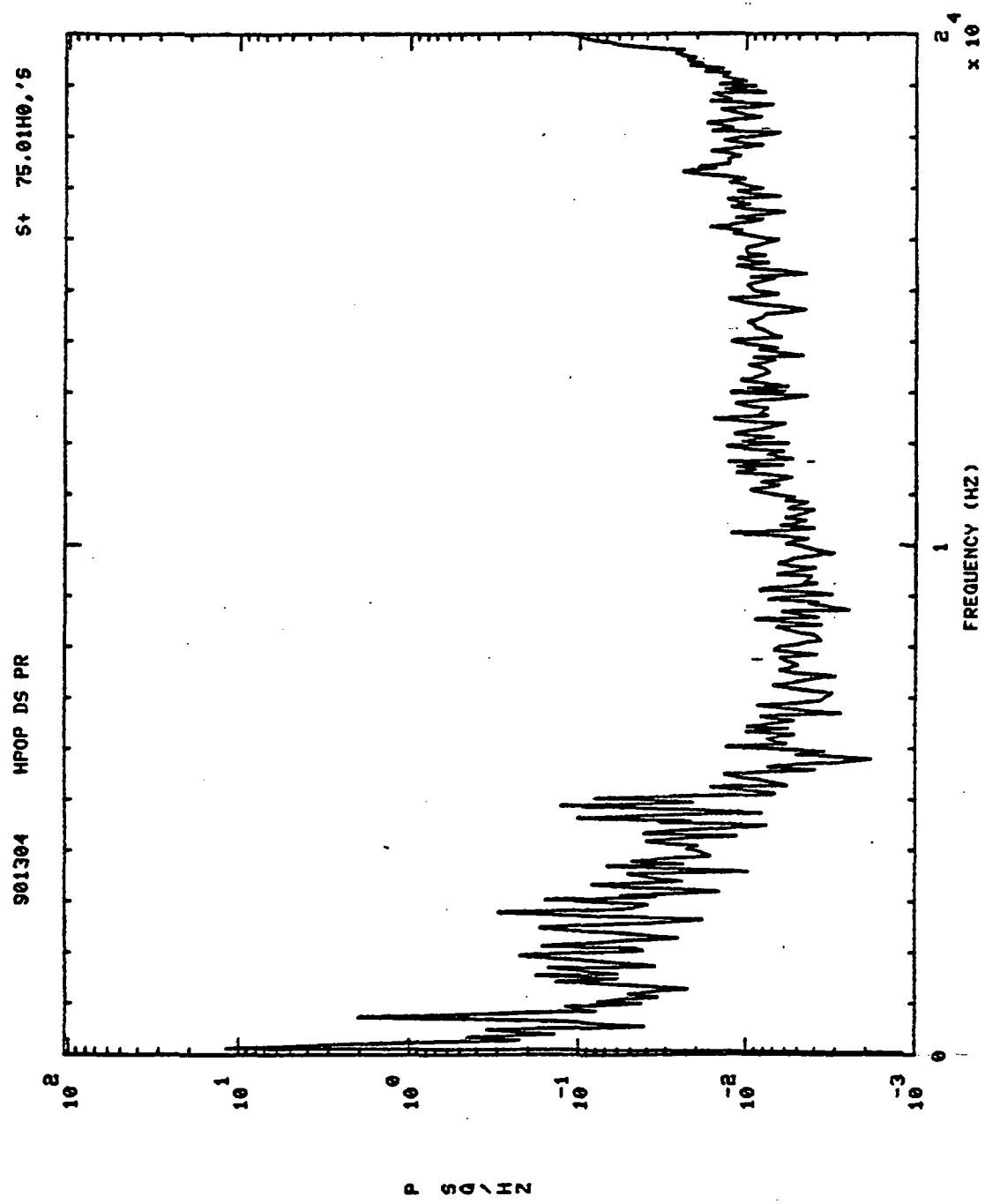
801303 OPB PC PR DC



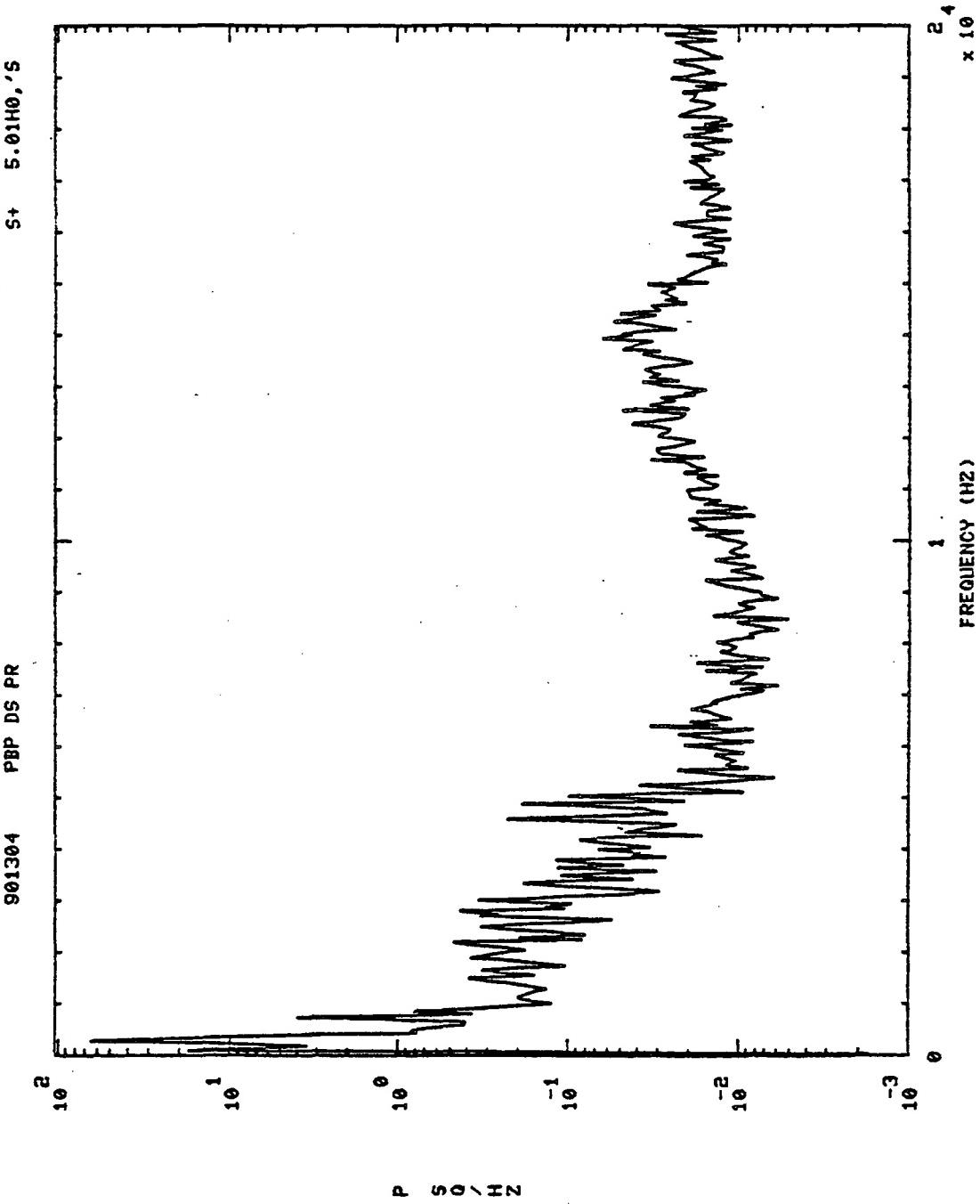


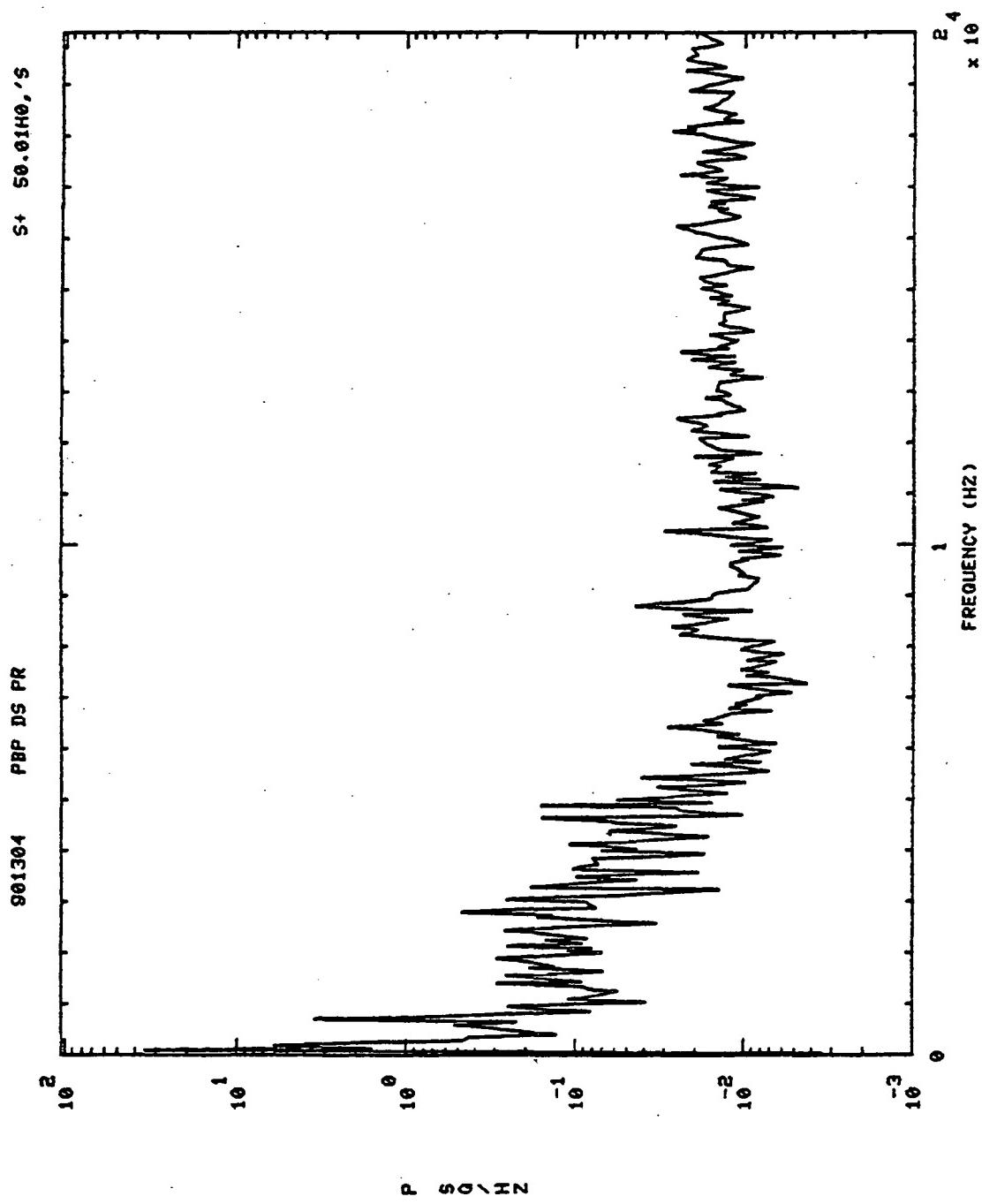
S+ 50.0140.5
901304 HPOP DS PR





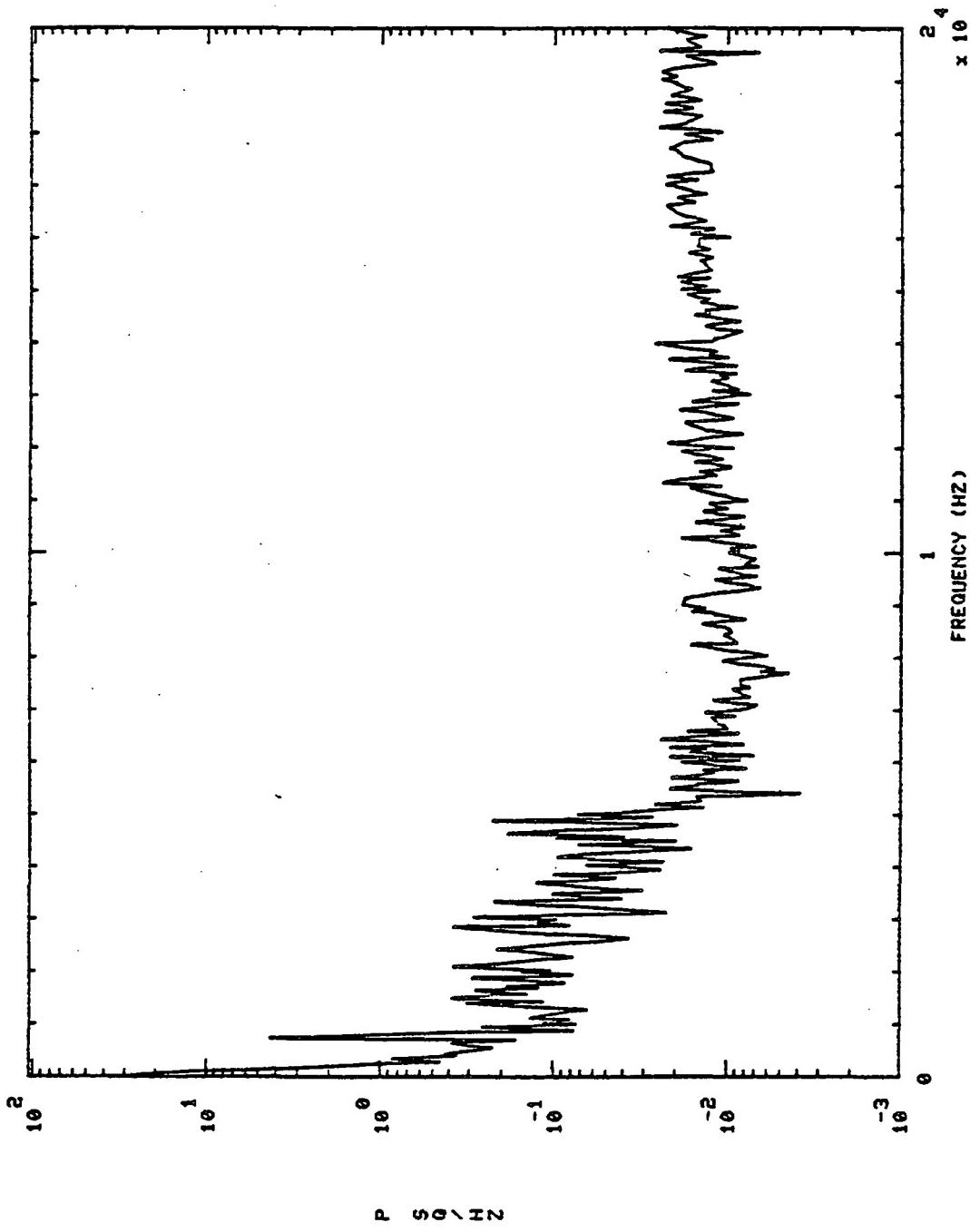
901304 PBP DS PR

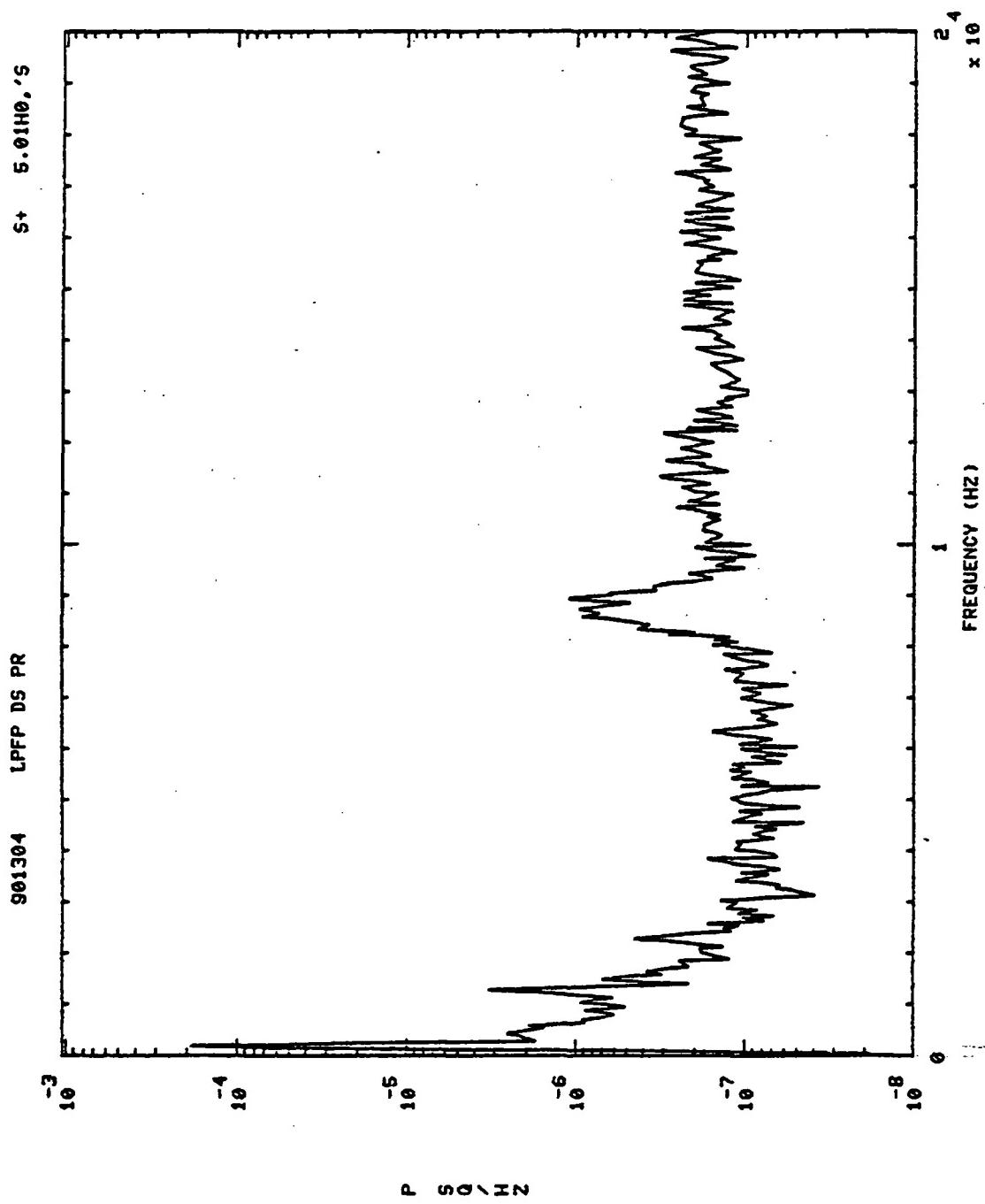




901304 PBP DS PR

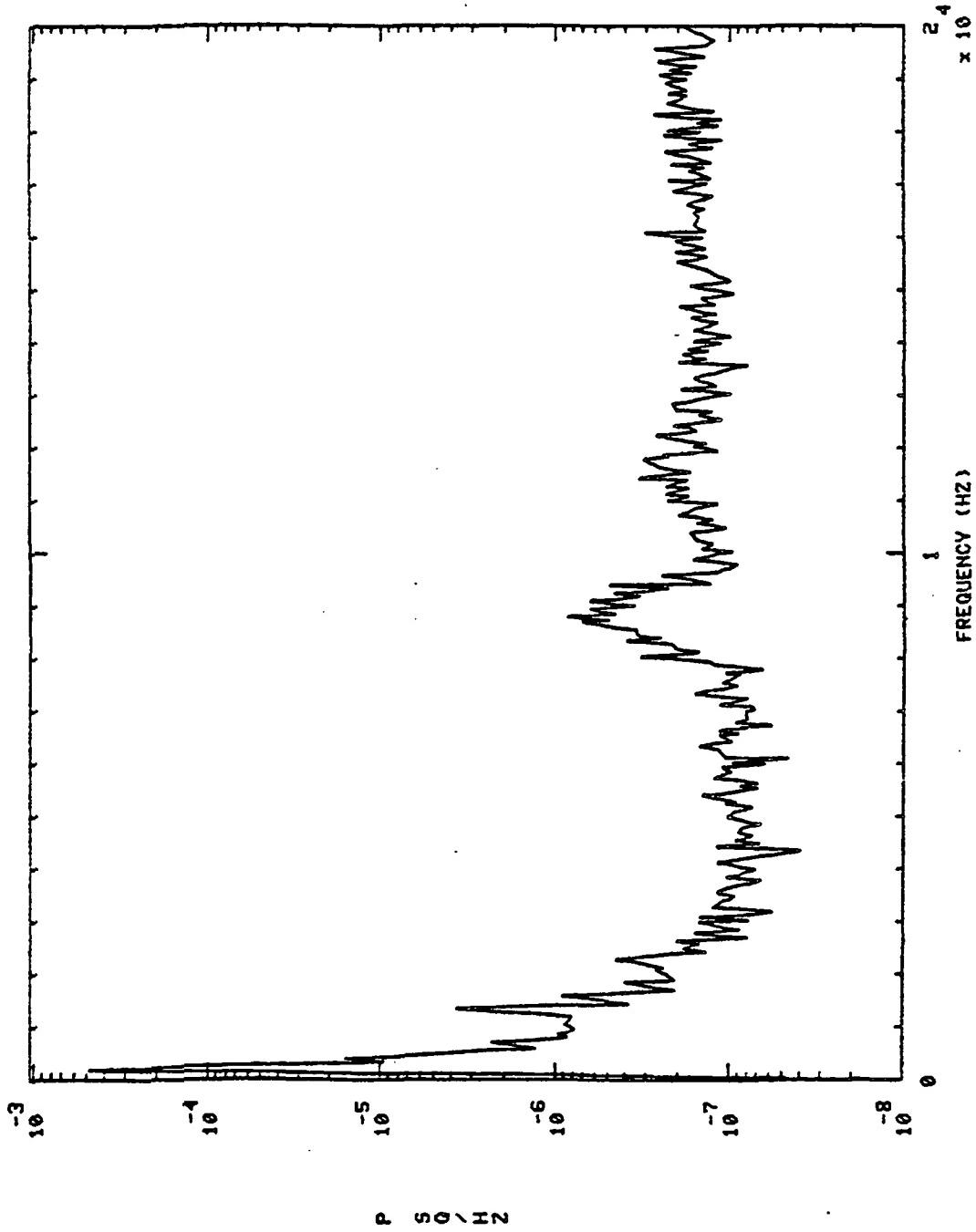
S+ 75.01H0, 'S

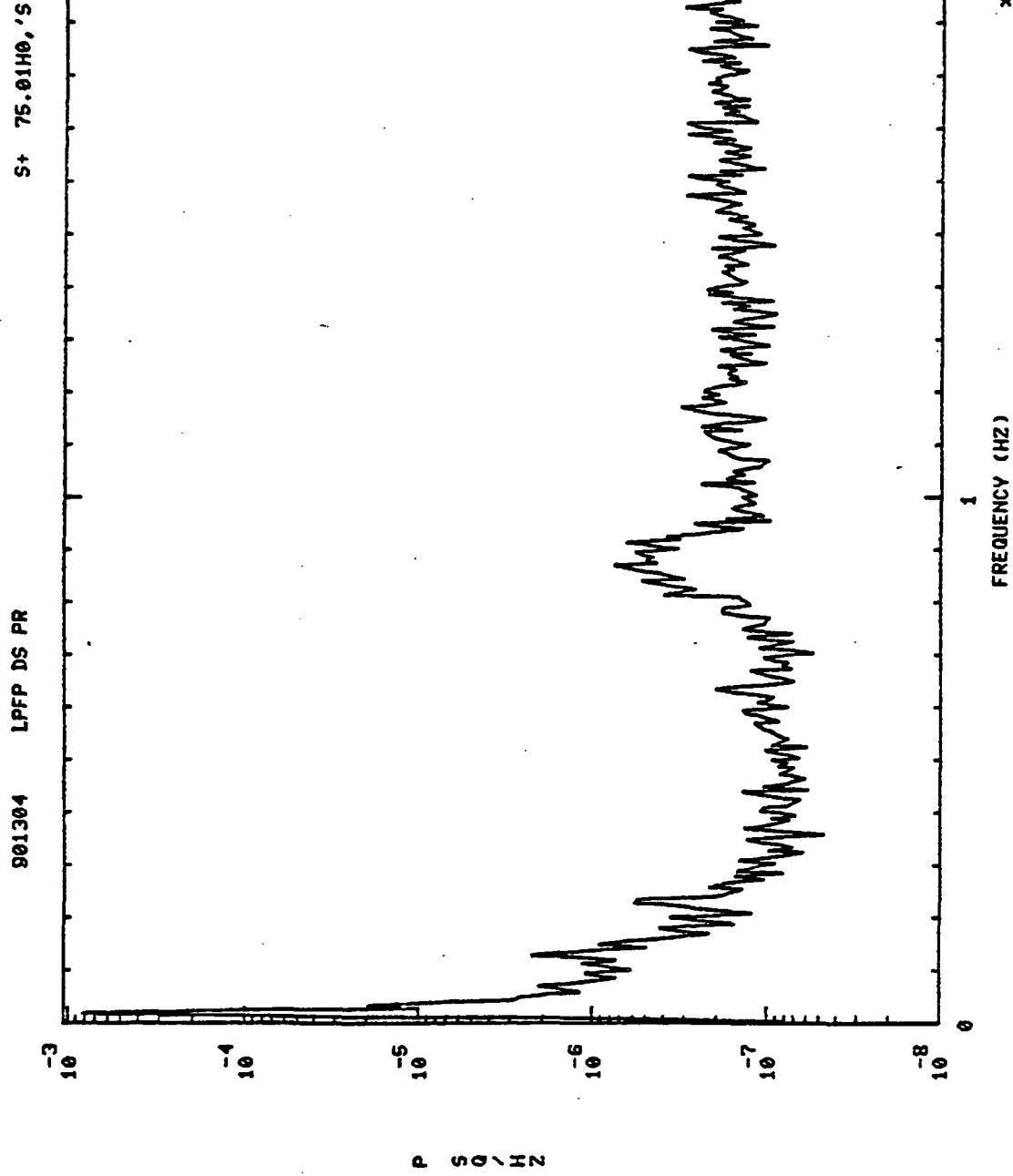




901304 LPFP DS PR

S+ 50.01Hz, 'S



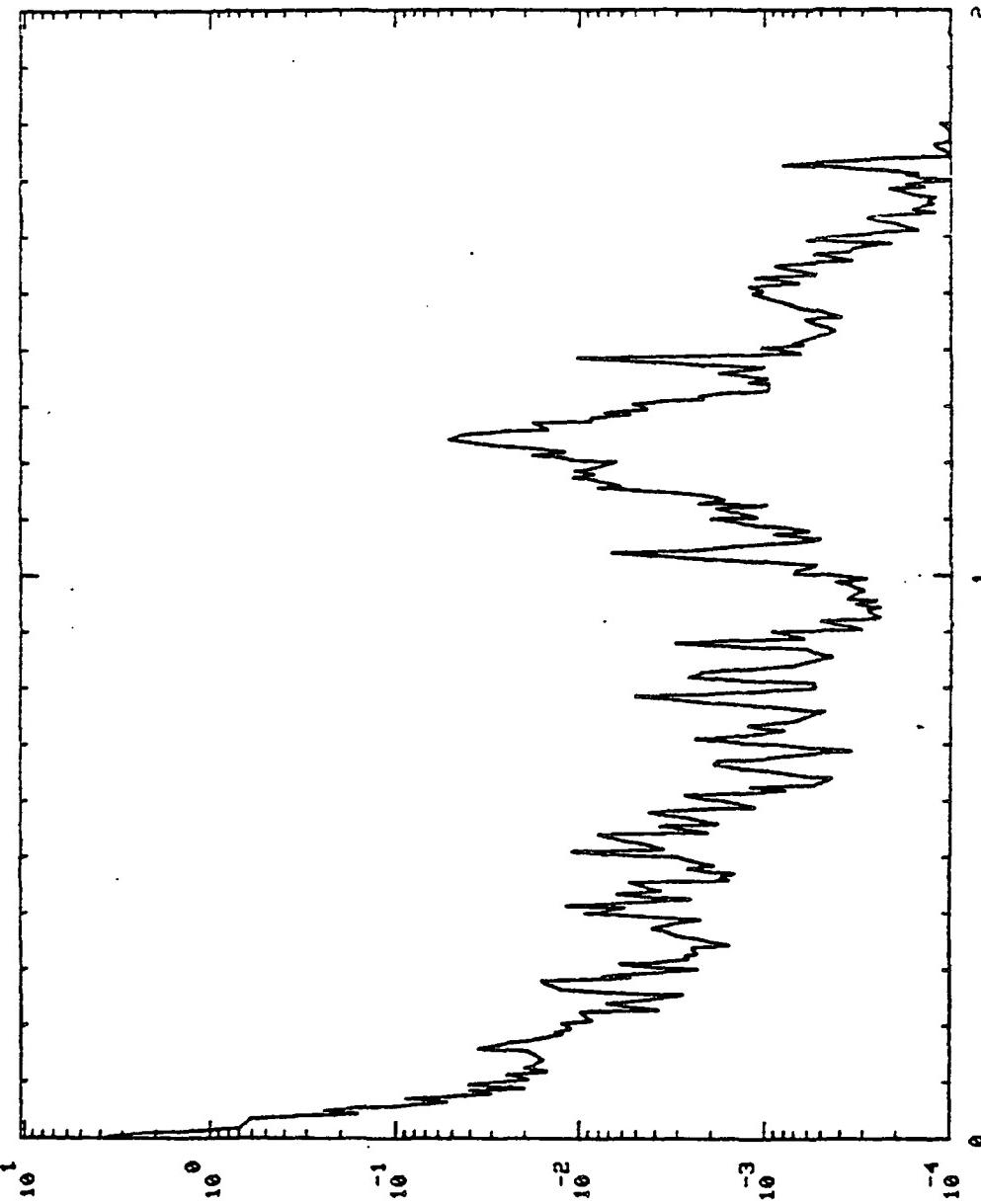


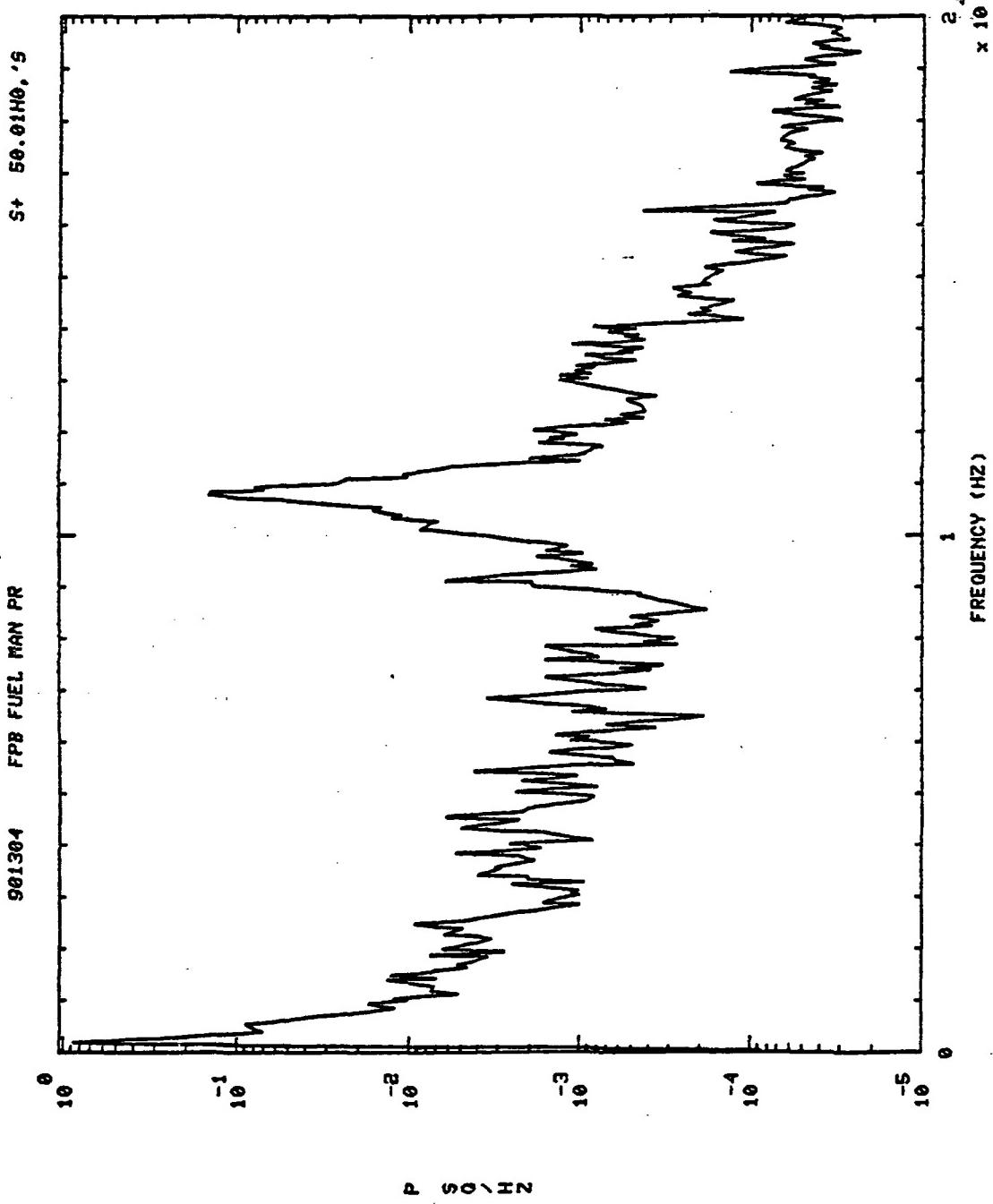
901304 FPB FUEL MAN PR

St 5.0140, 'S

P S/G/HZ

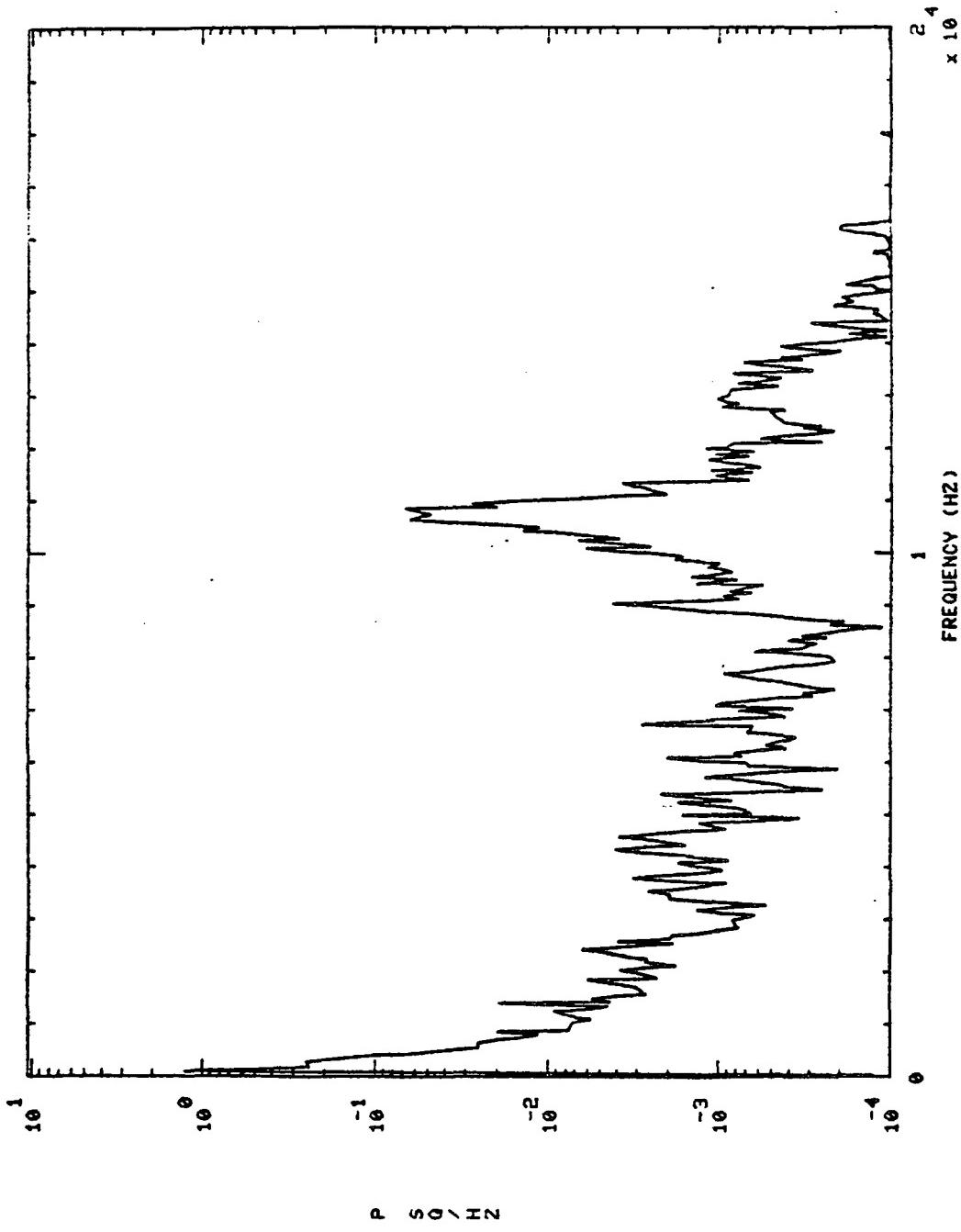
2 4
x 10
FREQUENCY (HZ)

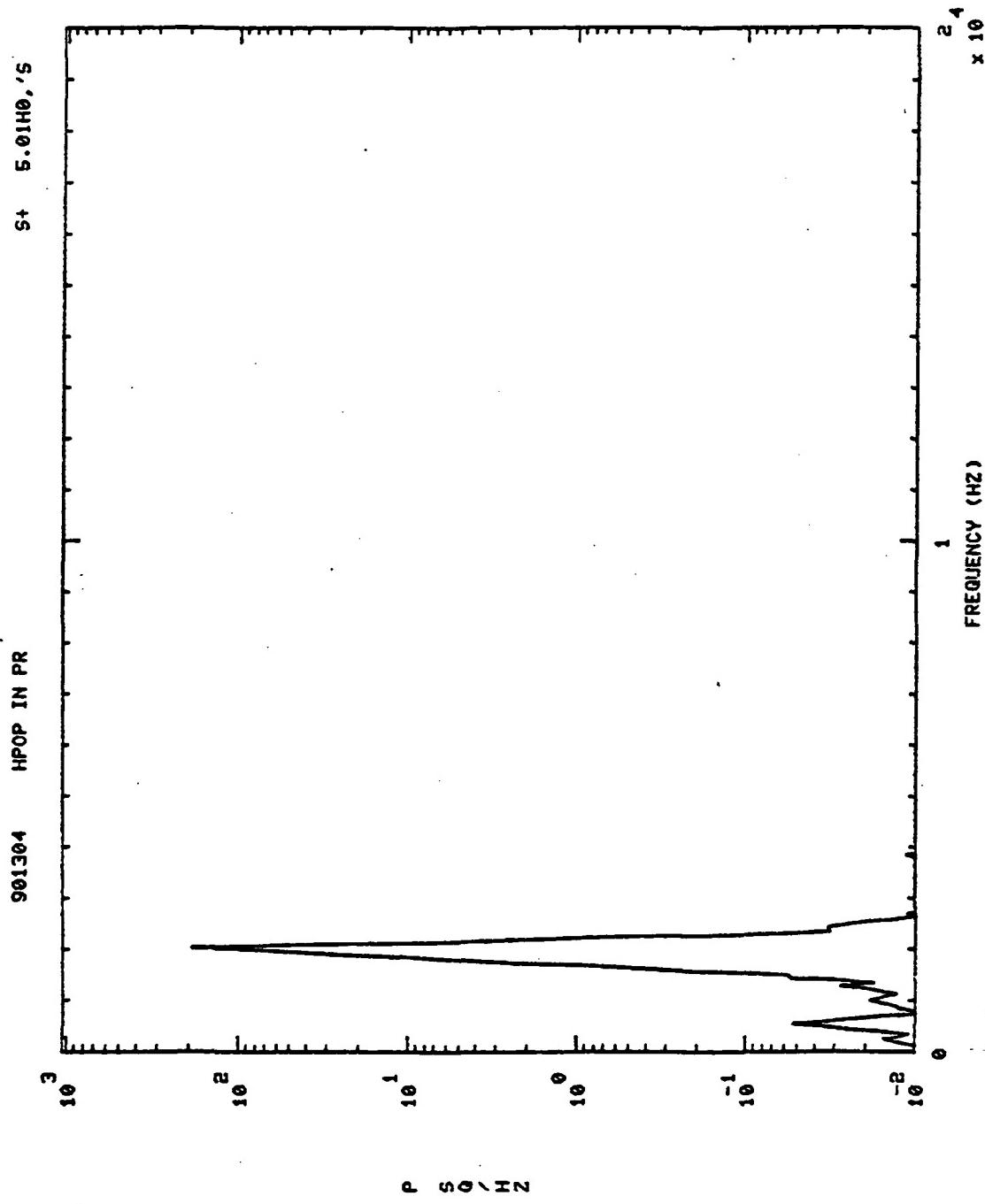




901364 FPB FUEL MAN PR

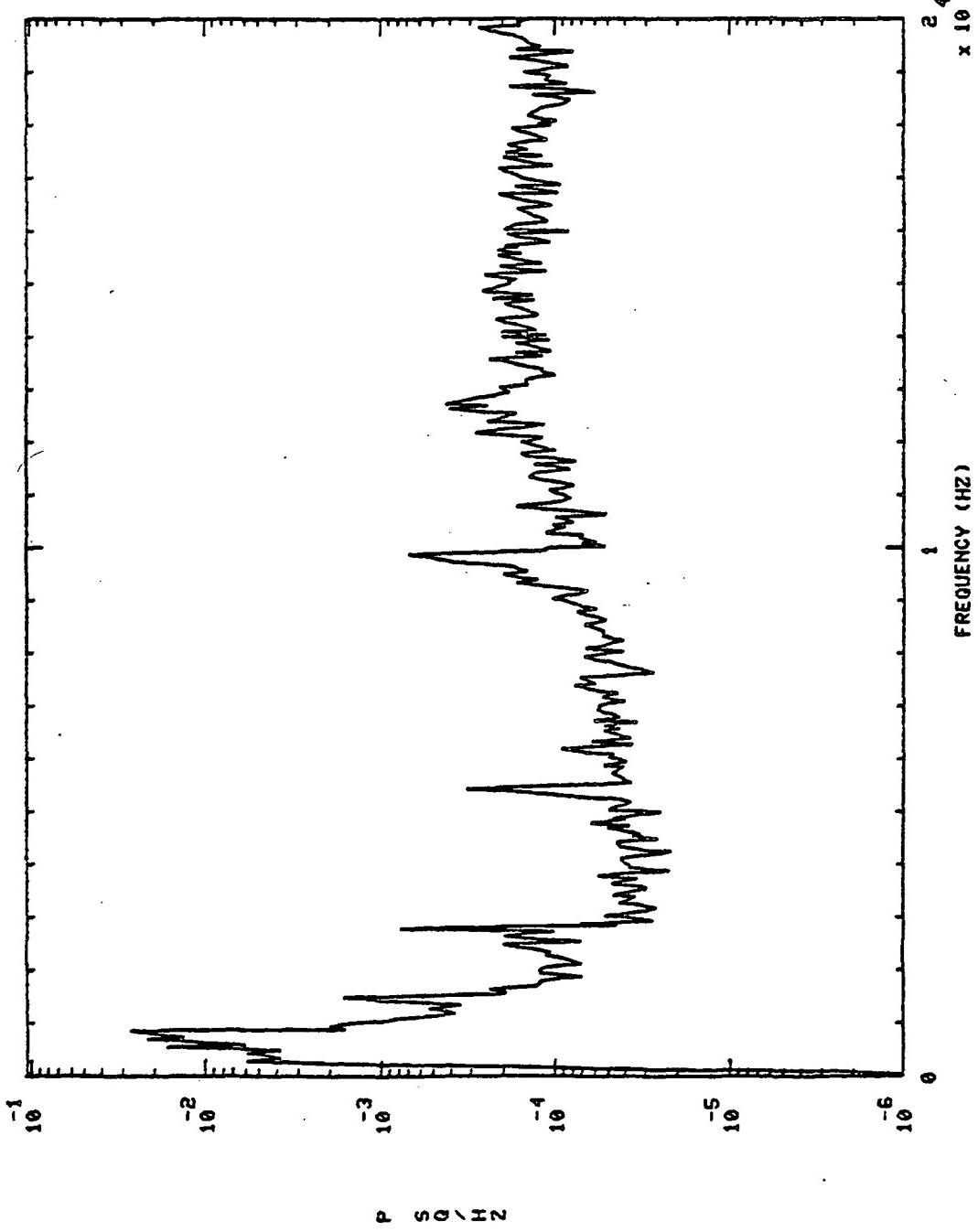
S+ 75.01H0, 'S

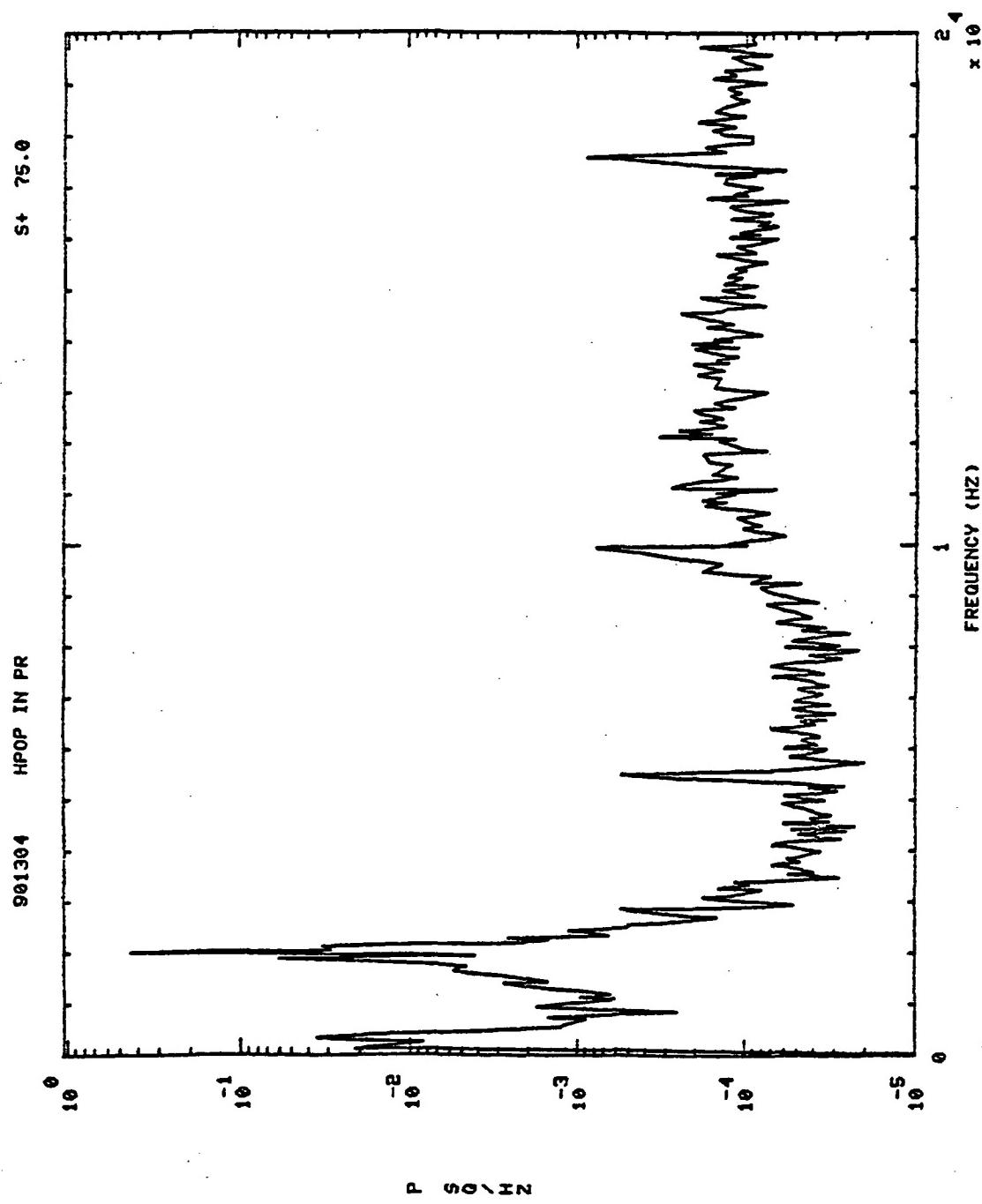


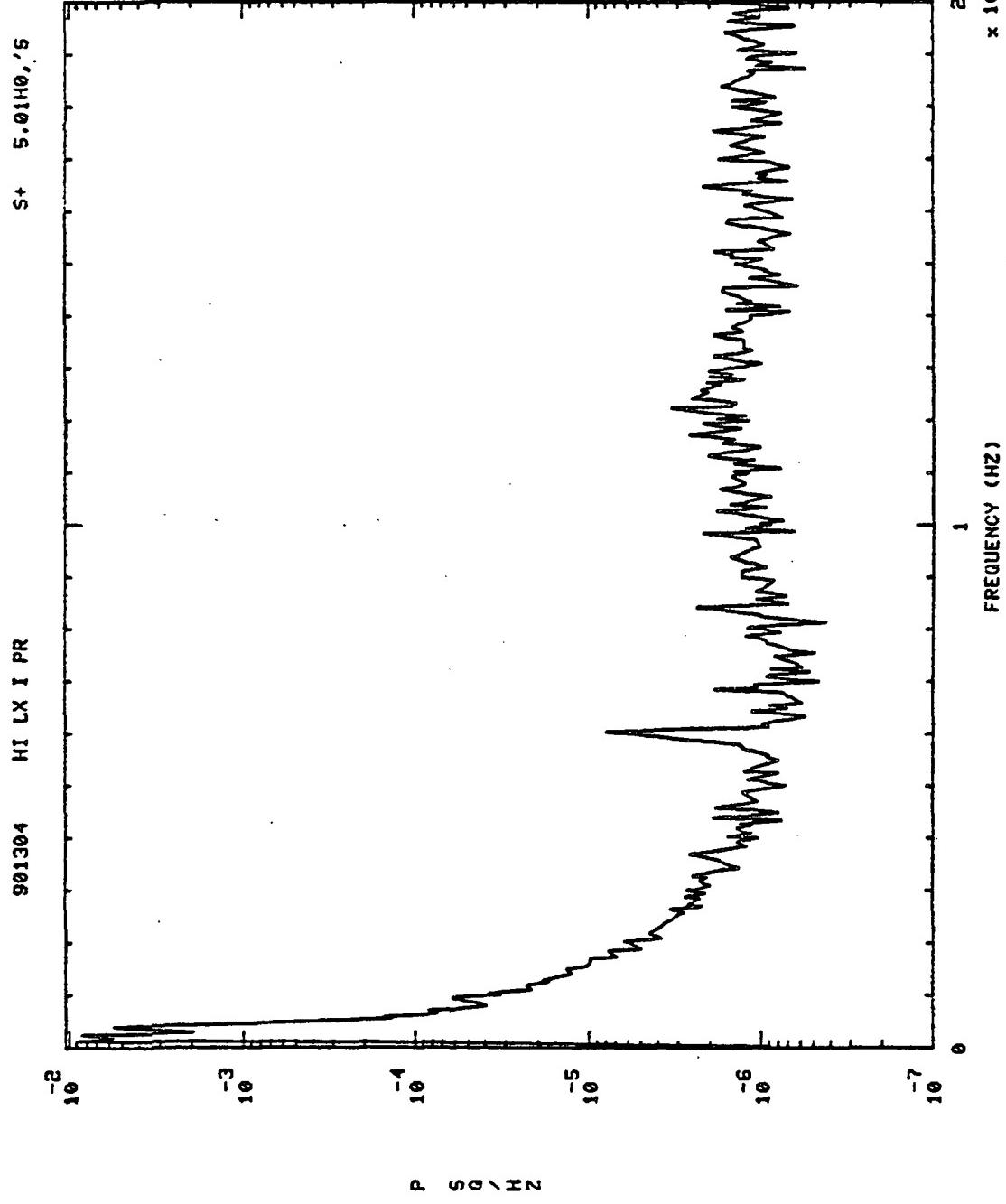


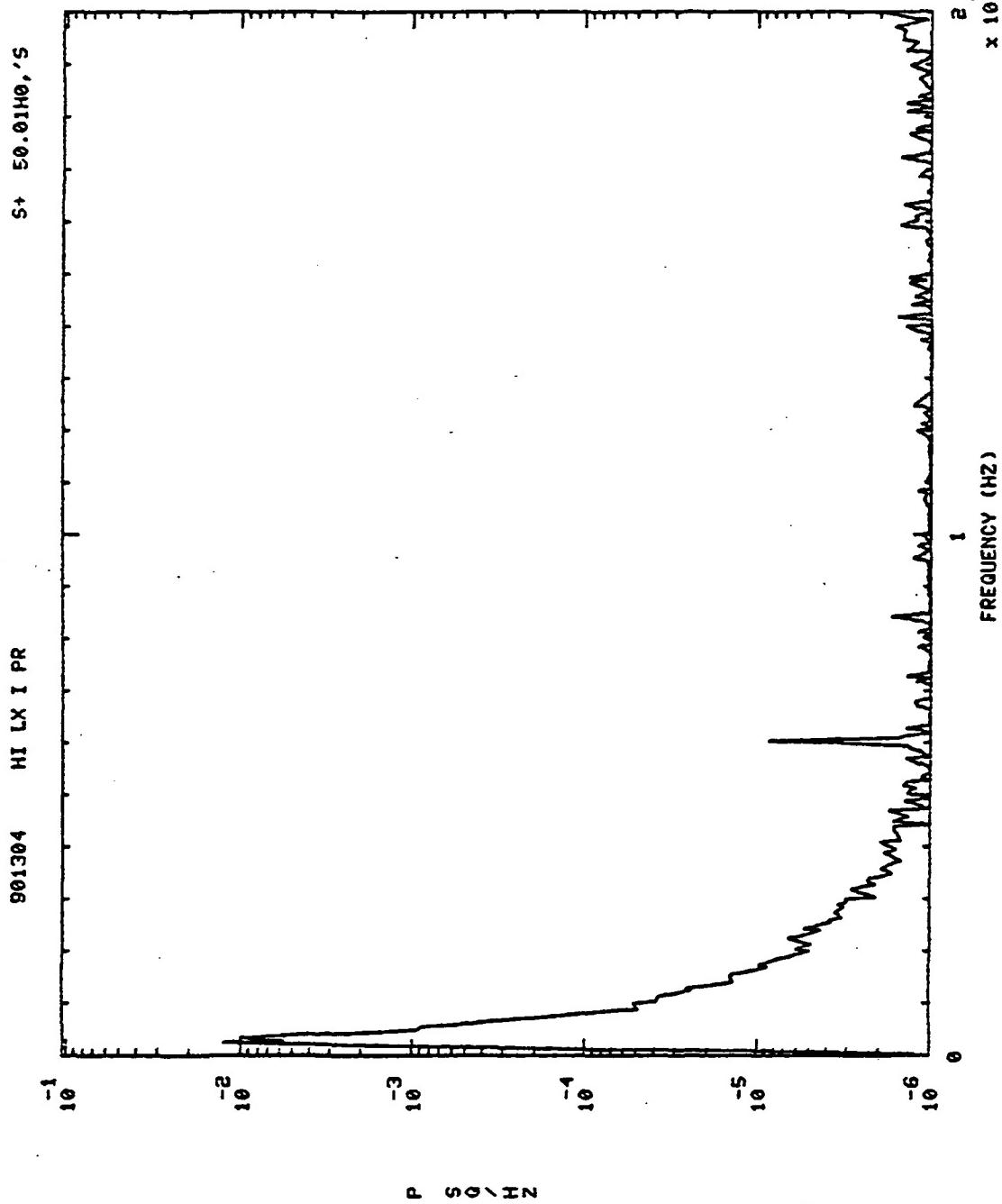
901304 HPOP IN PR

S+ 50.01H0, '5



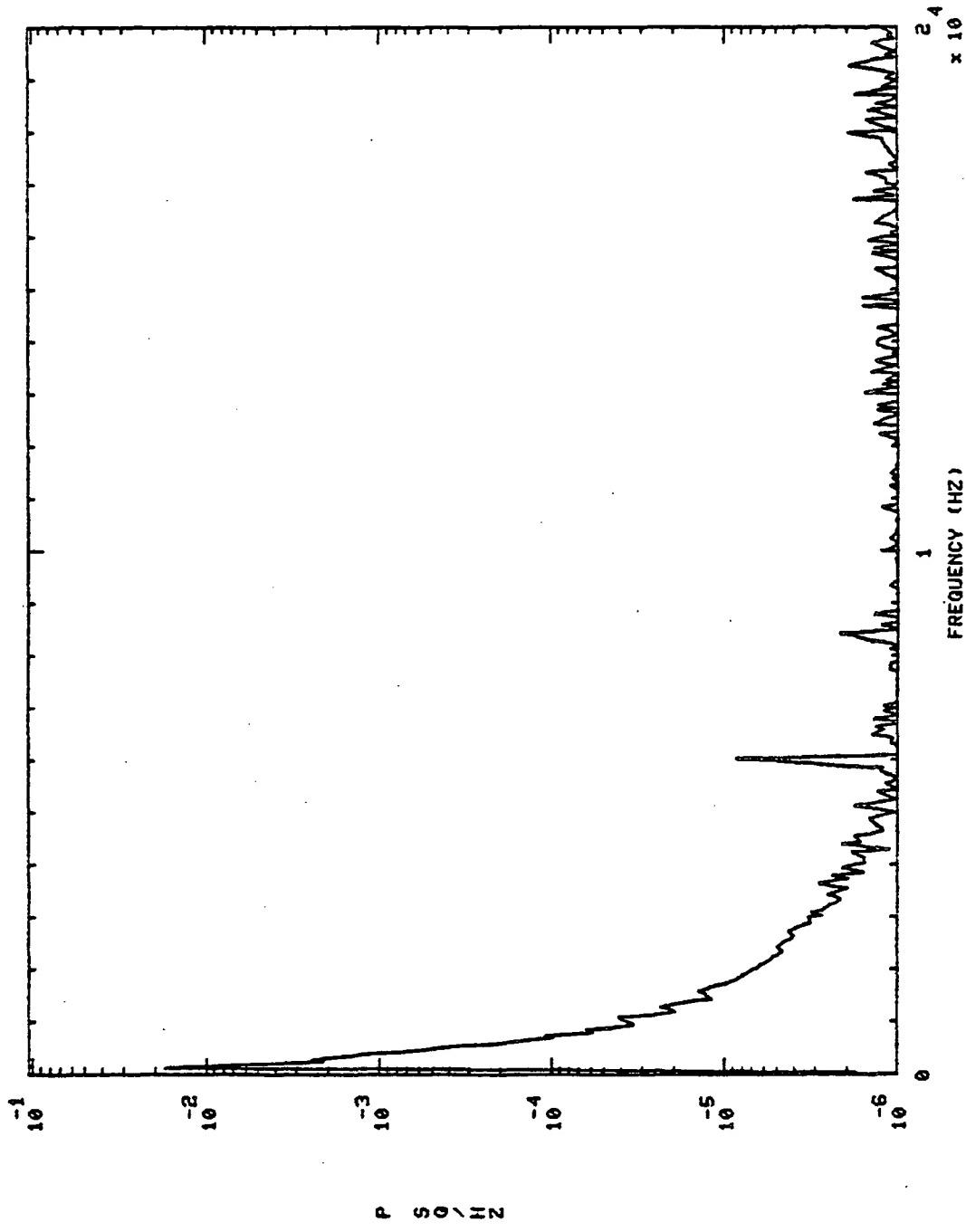


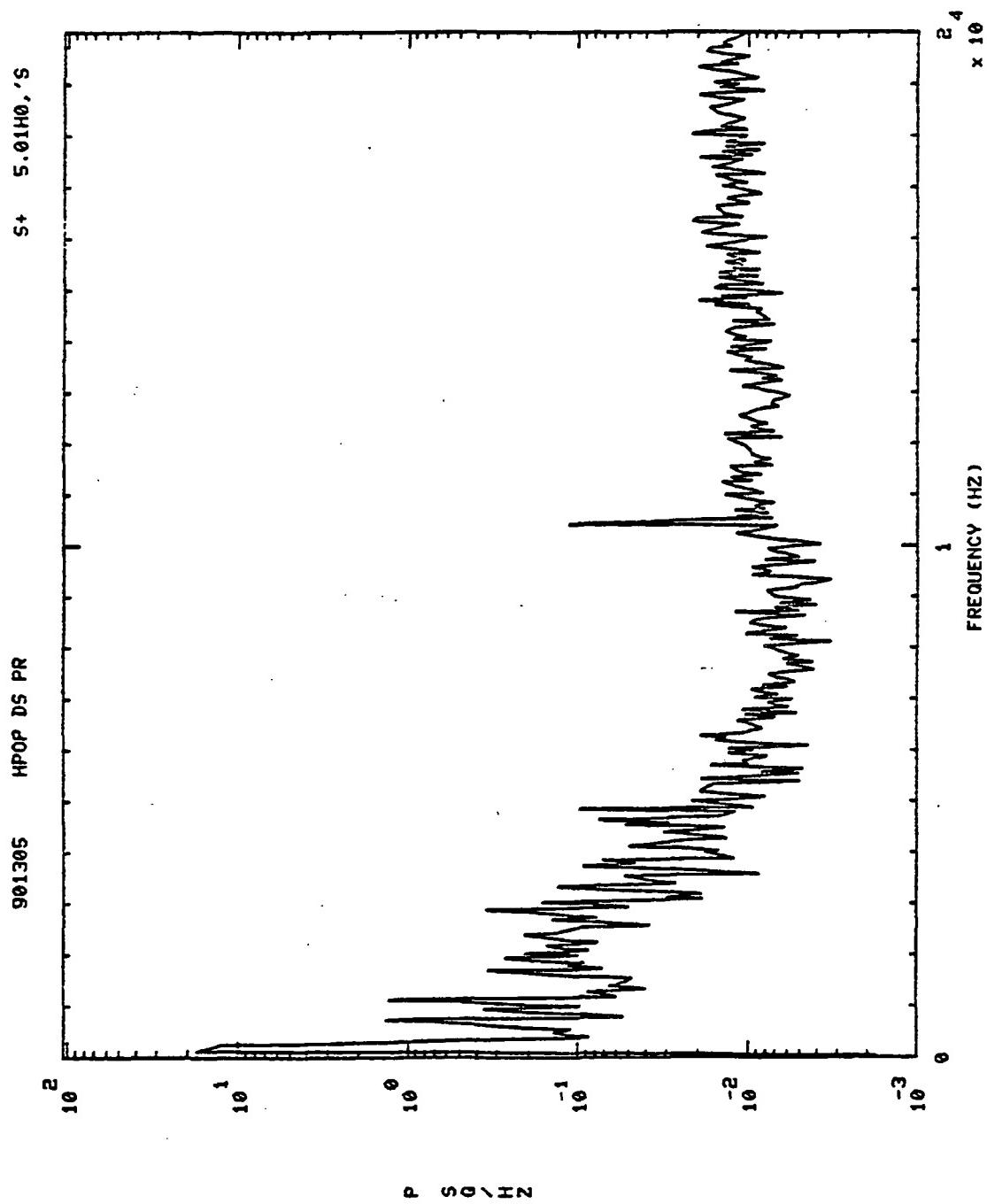




901304 HI LX I PR

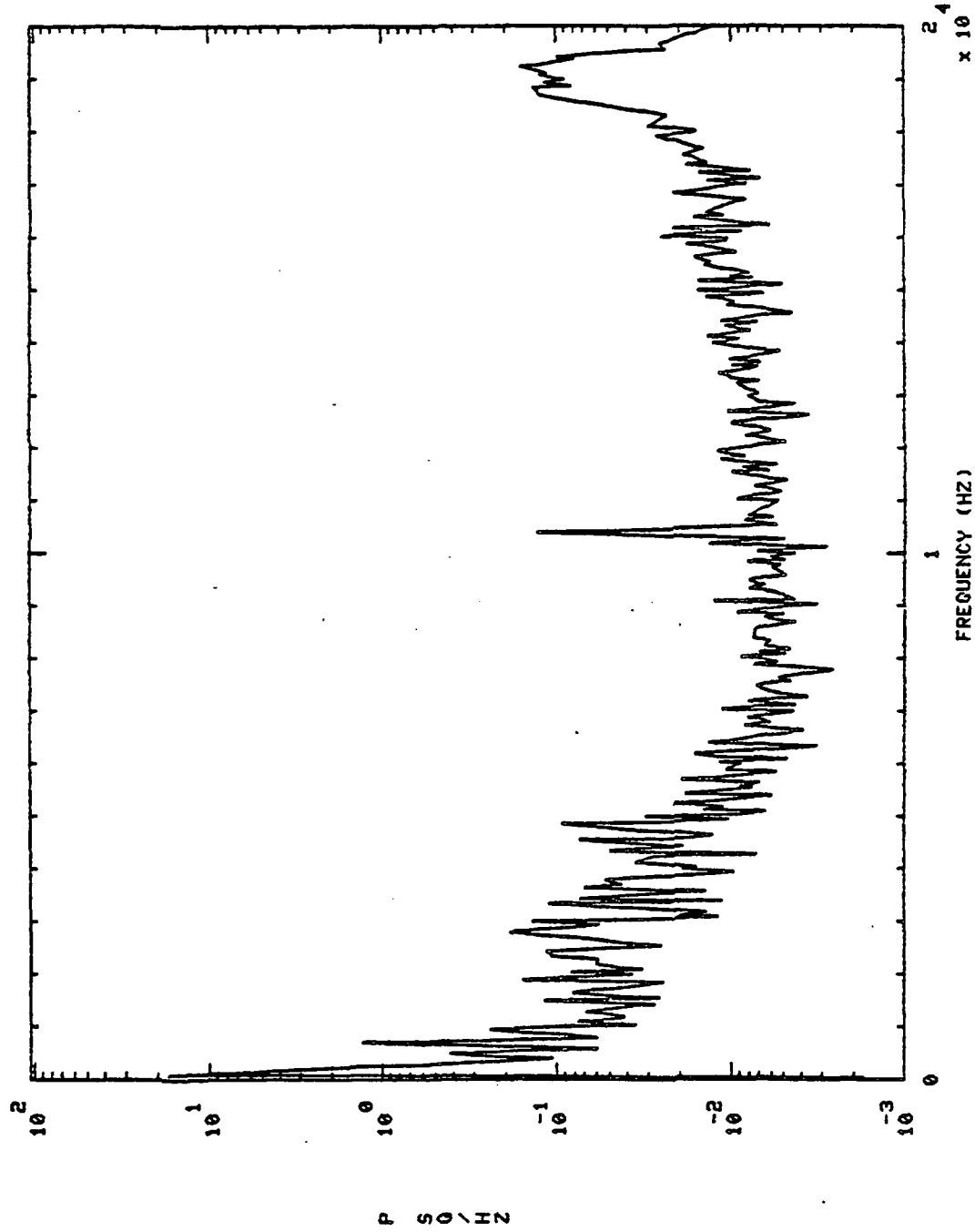
S+ 75.01H0.'S

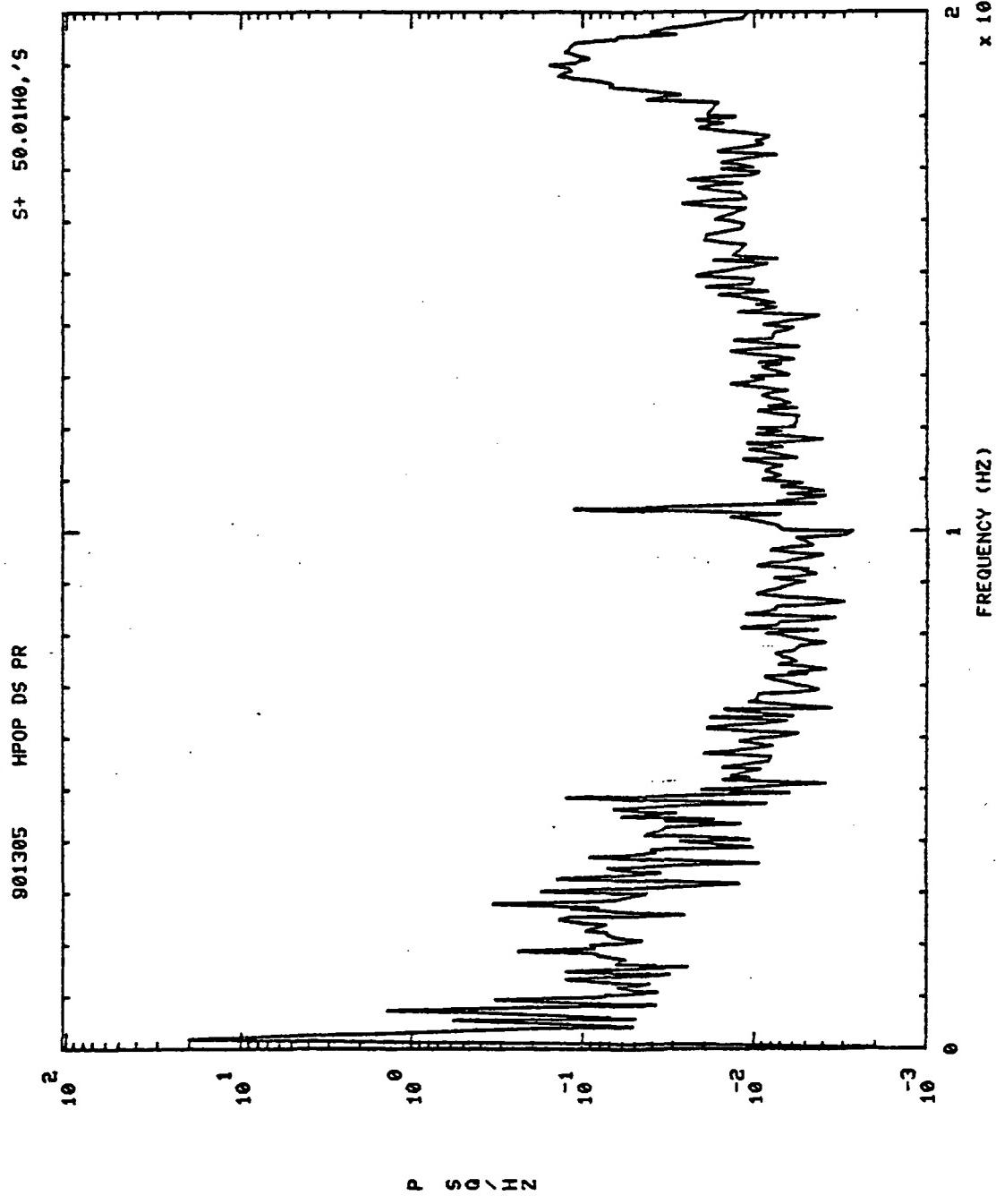




S+ 25.01H0, 'S

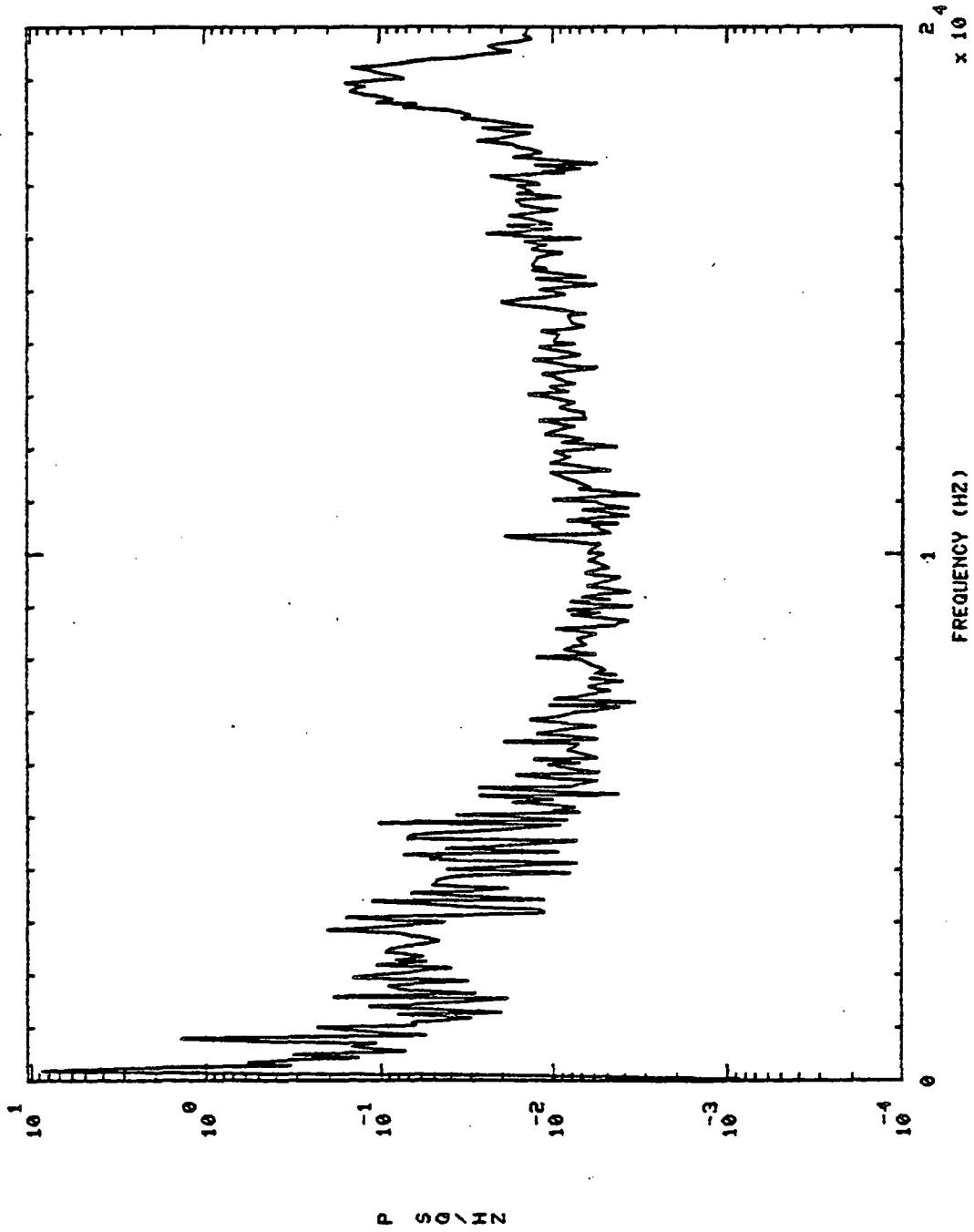
901305 HPOP DS PR

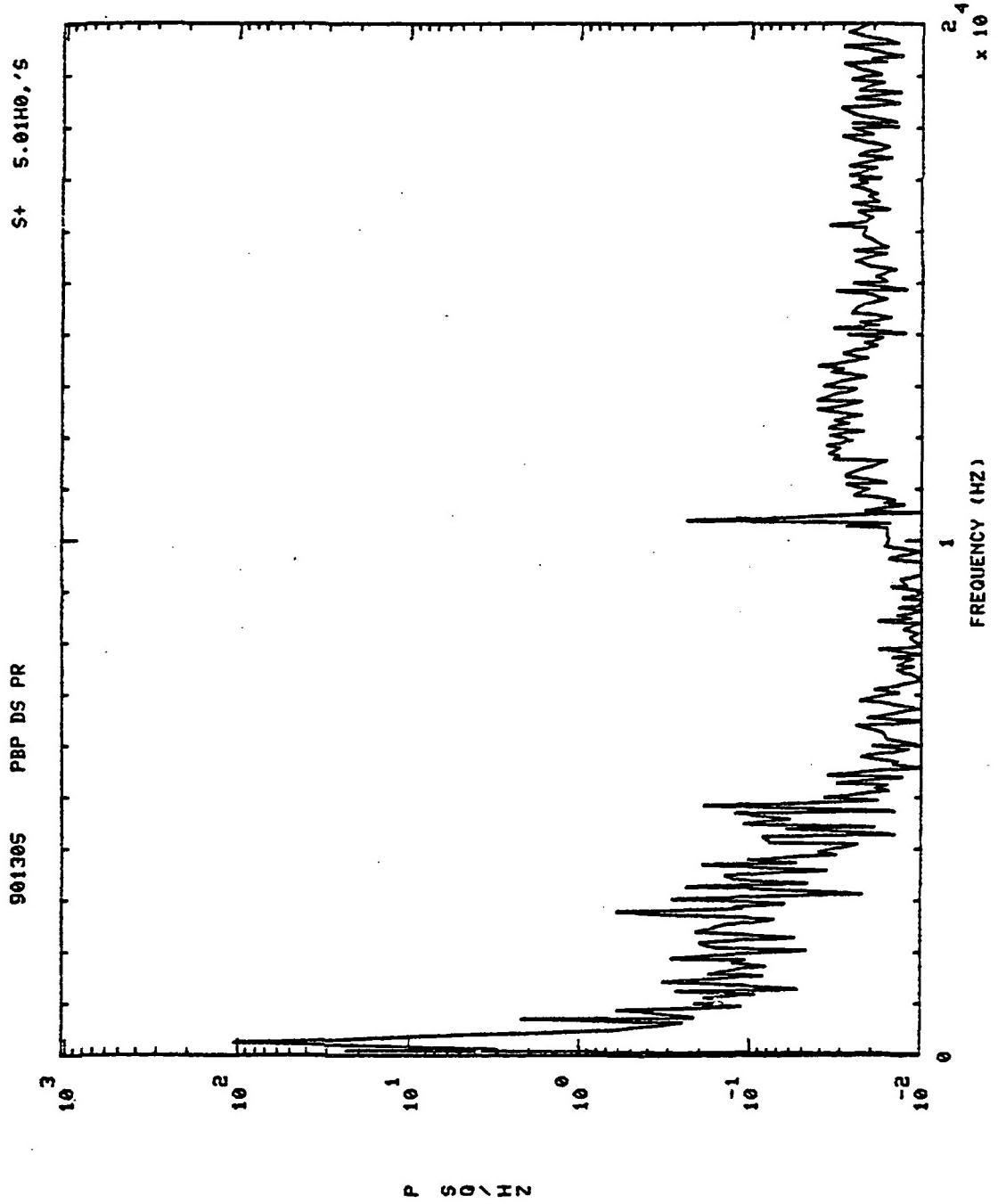




S+ 75.01H0, 'S

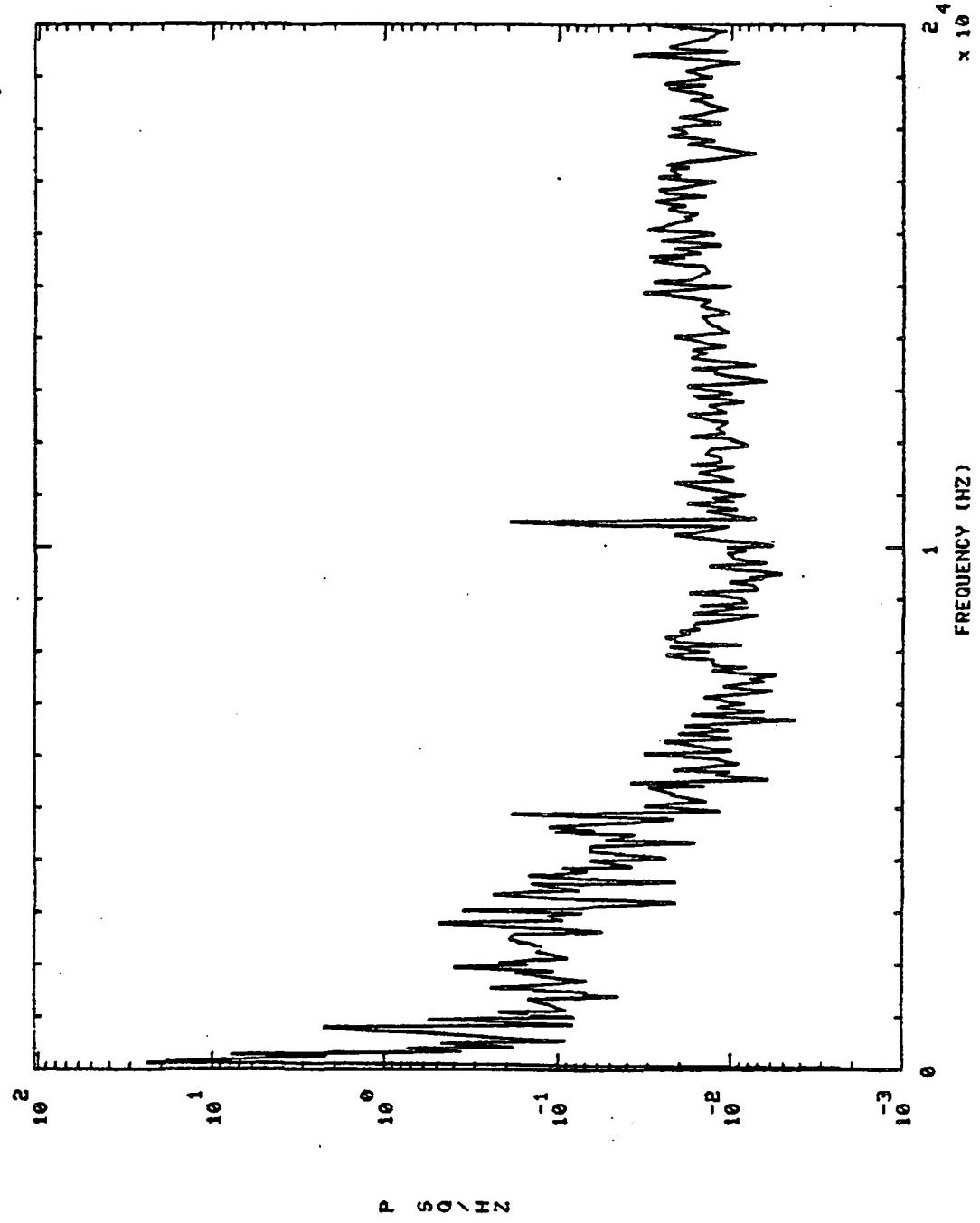
901305 HPOP DS PR

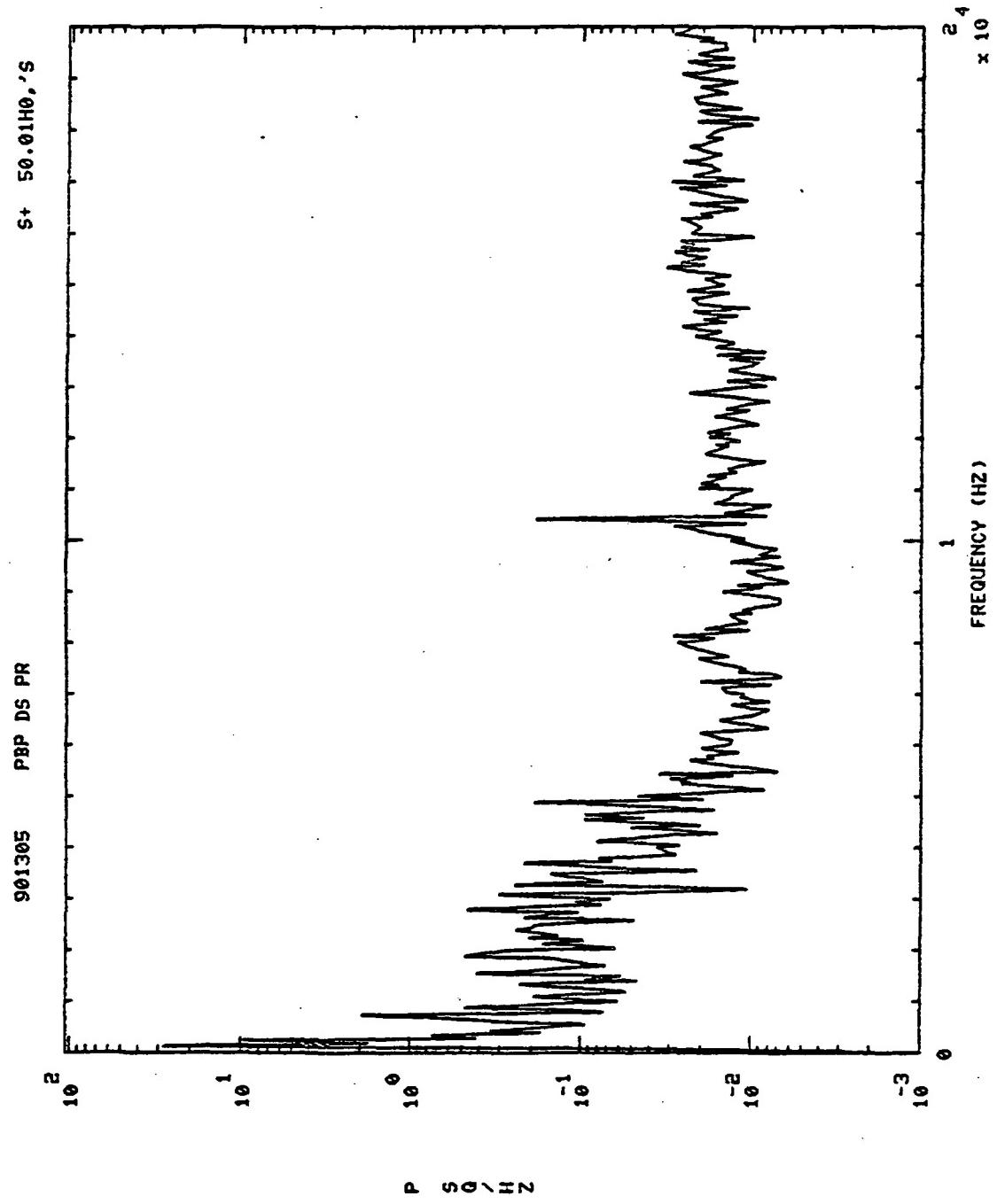




S+ 25.0110, 5

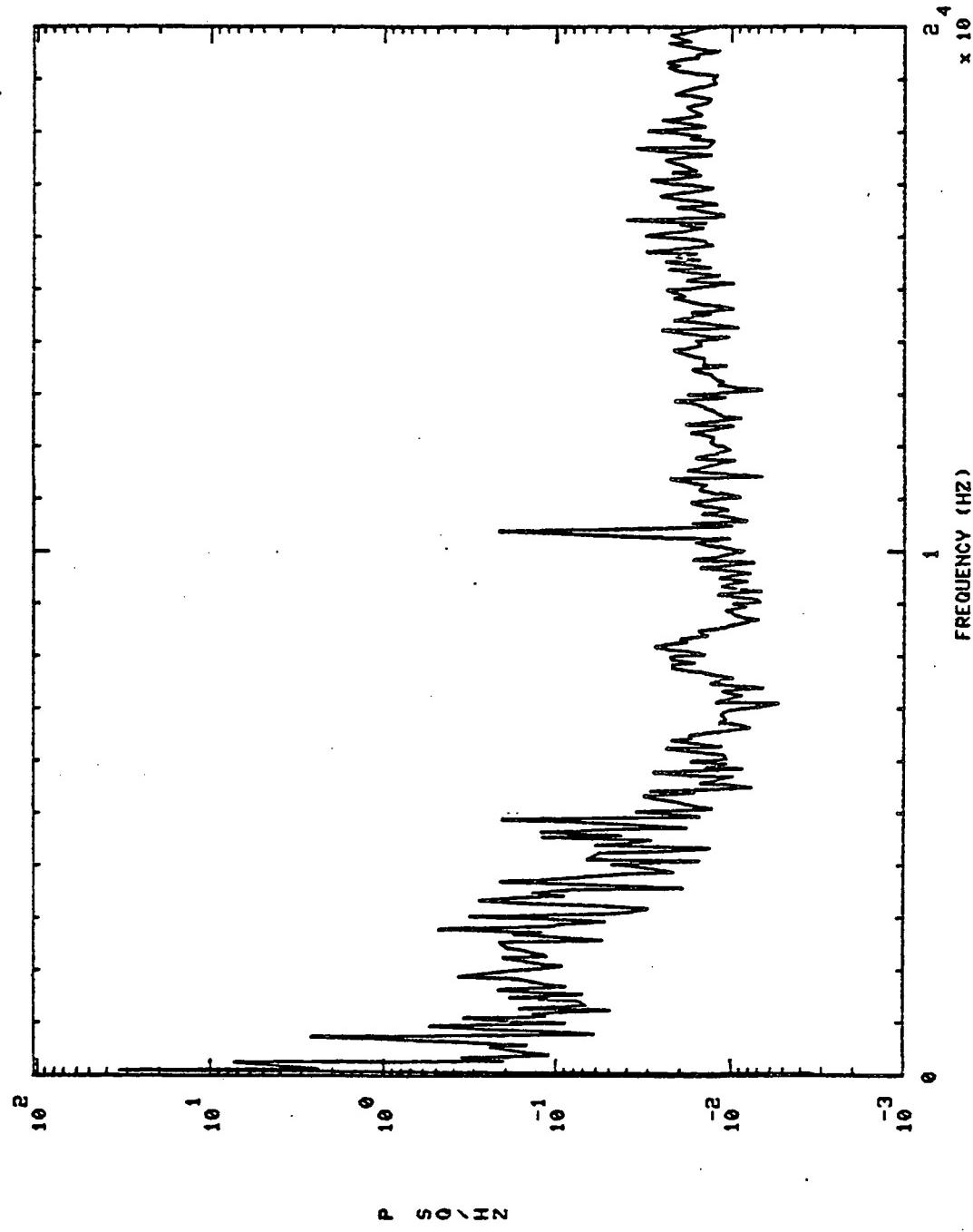
901305 PBP DS PR

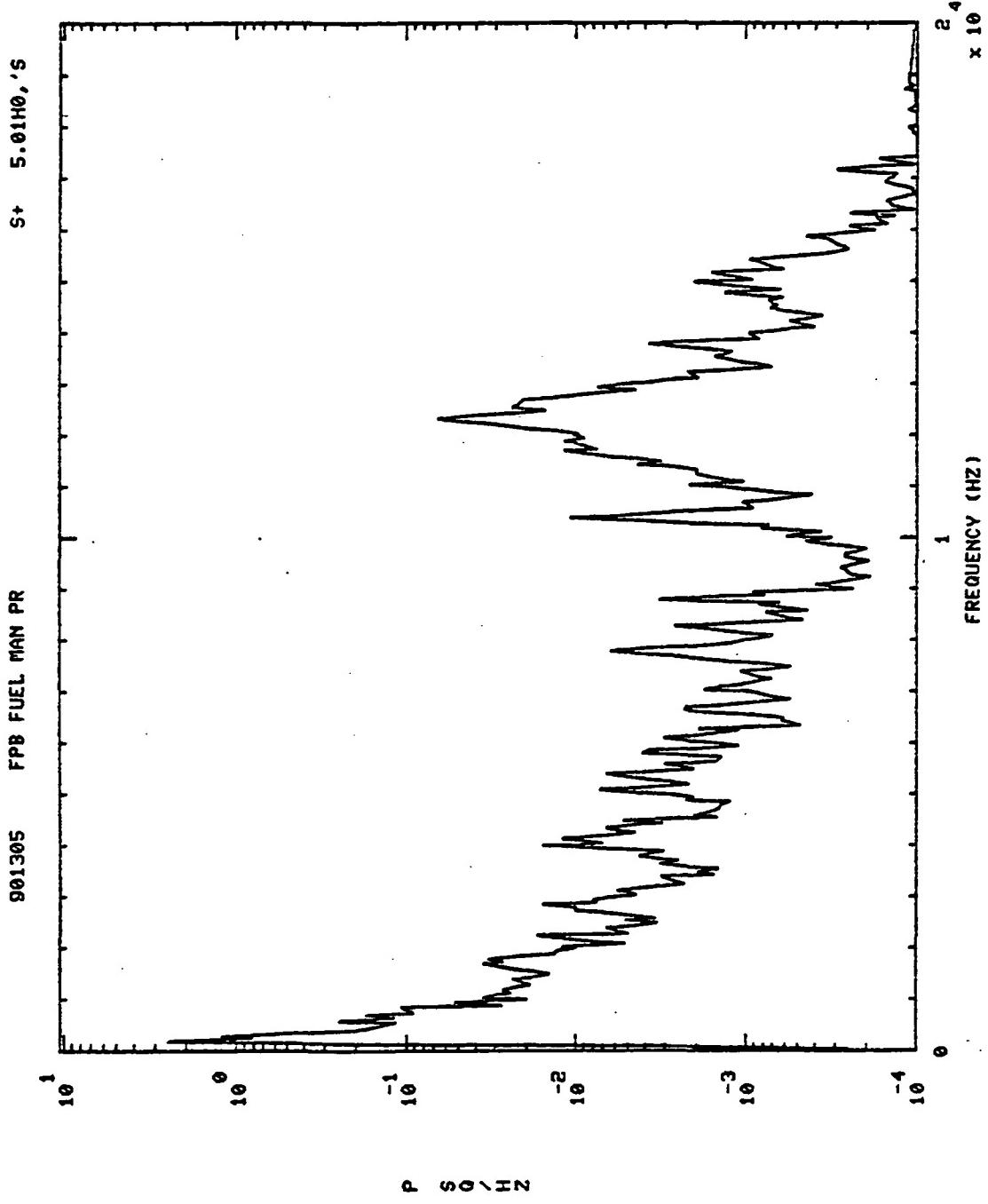




901305 PBP DS PR

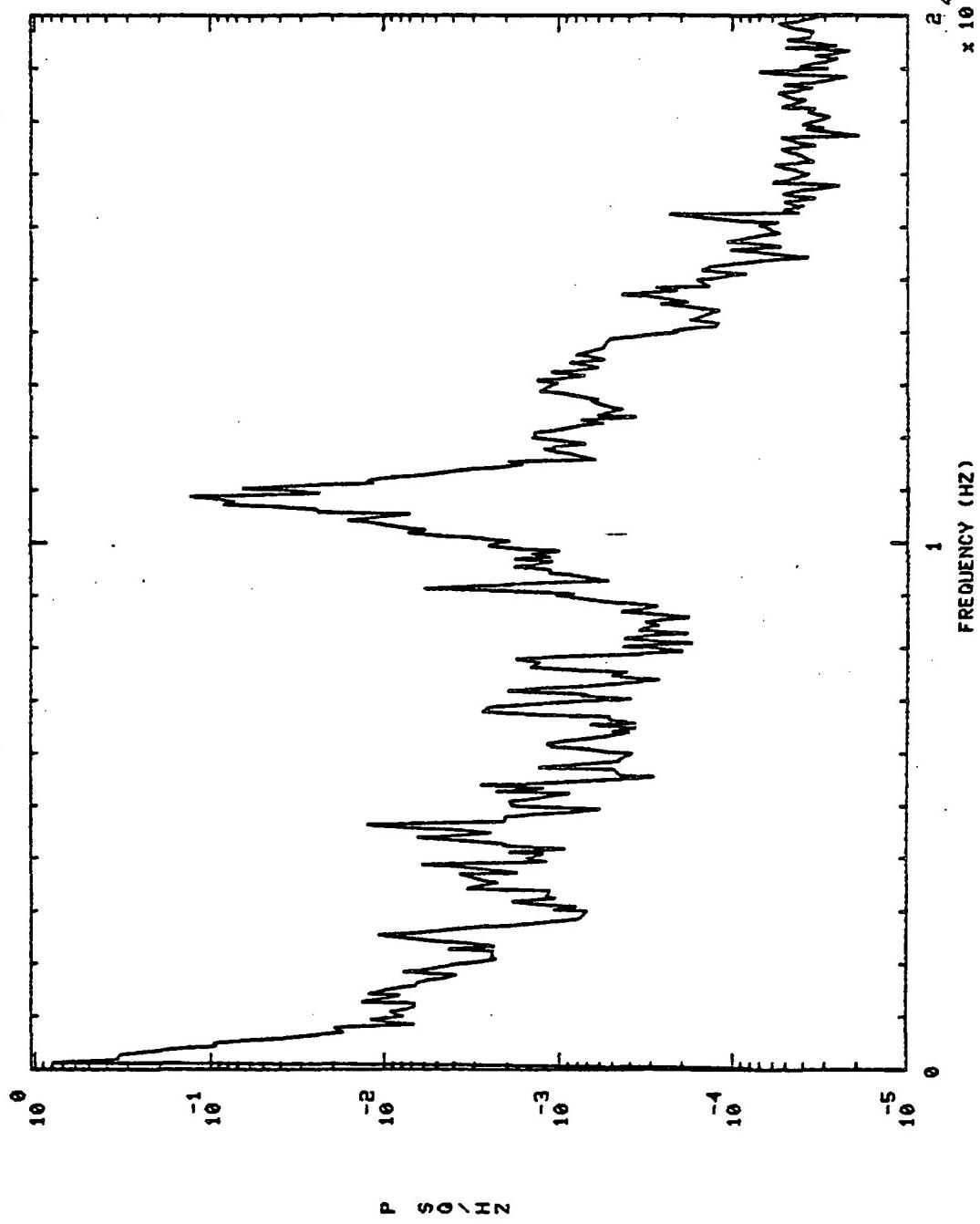
S+ 75.01H0, S

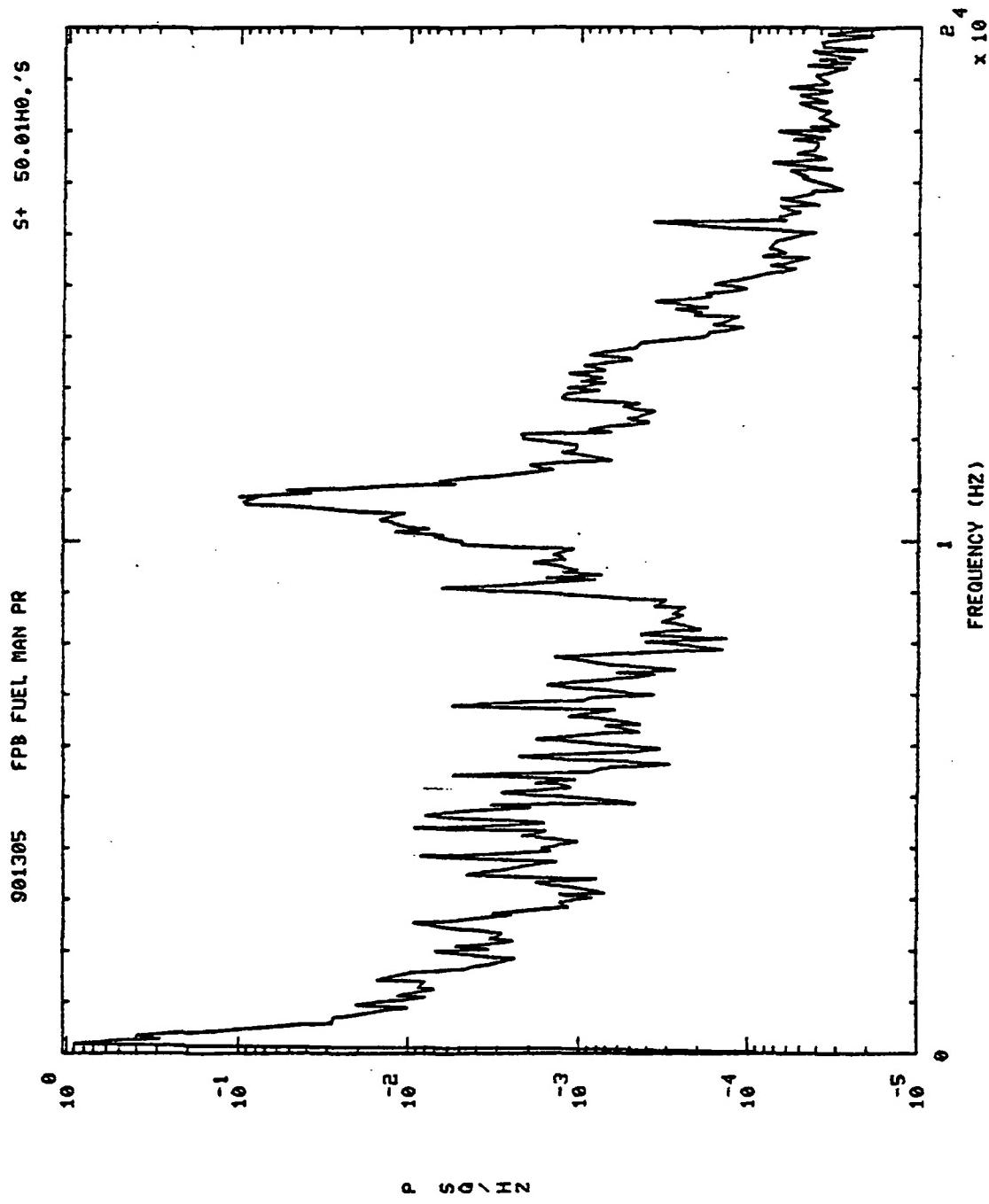




S+ 25.01H0.'S

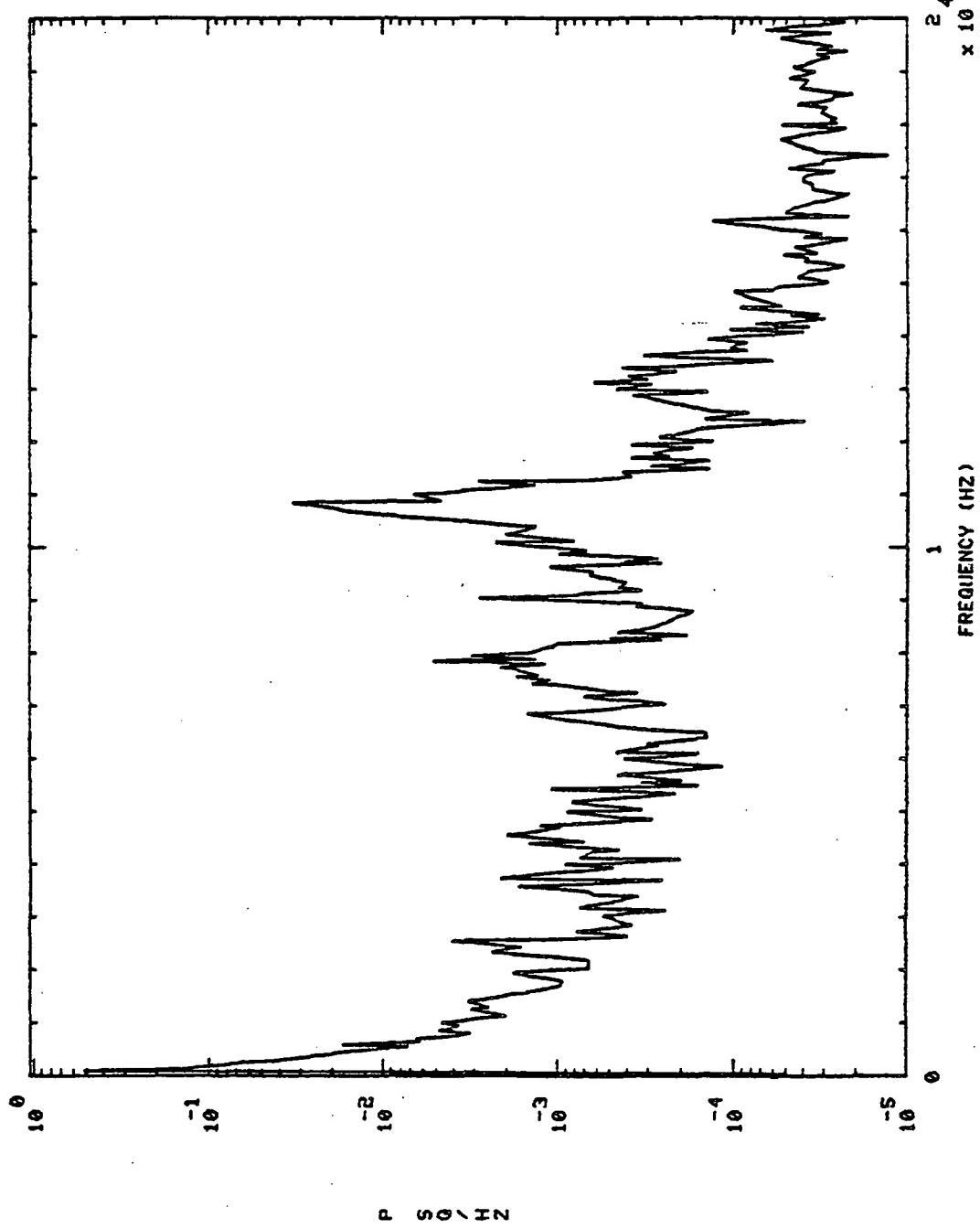
901365 FPB FUEL MAN PR

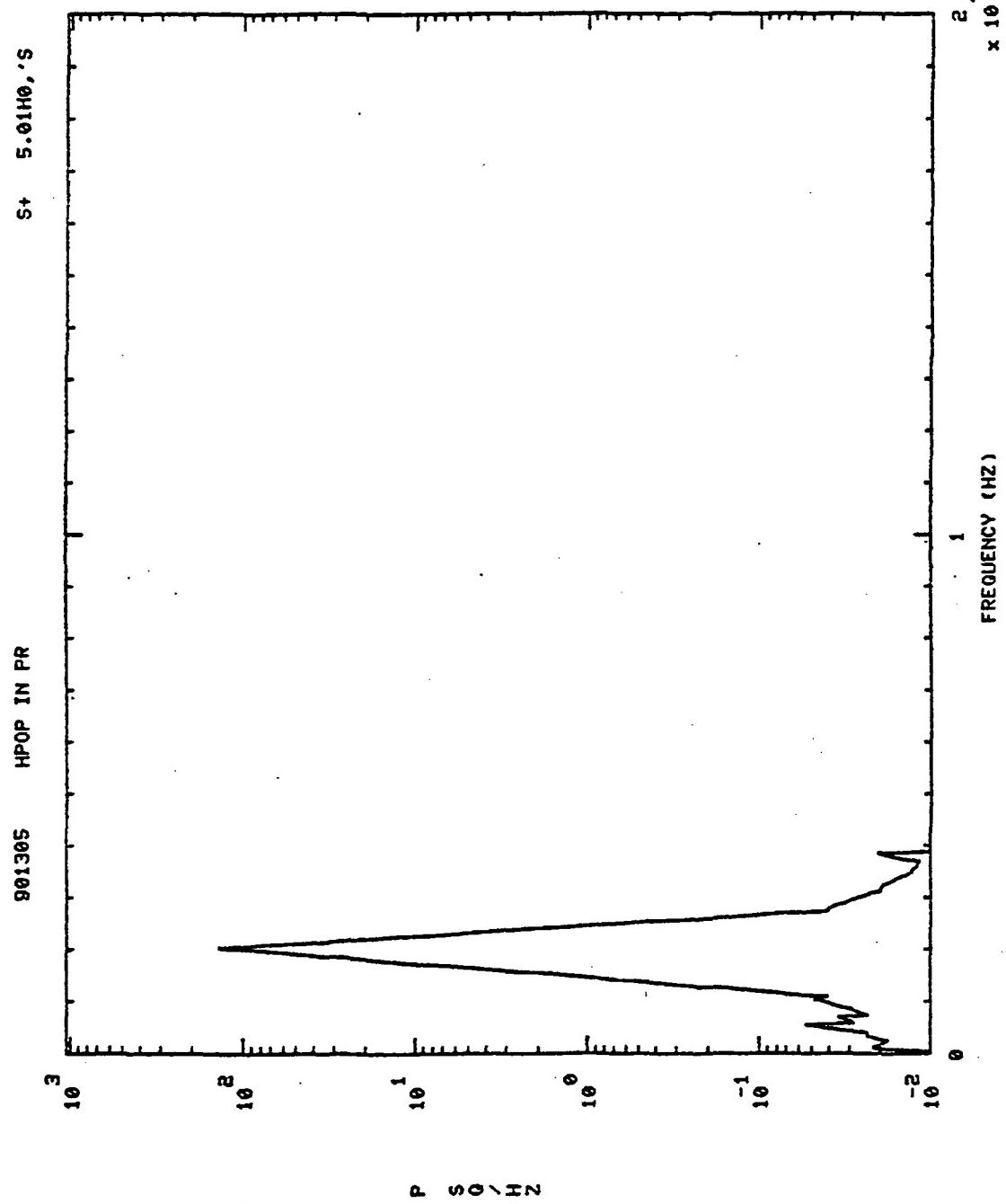




S+ 75.01H0, 'S

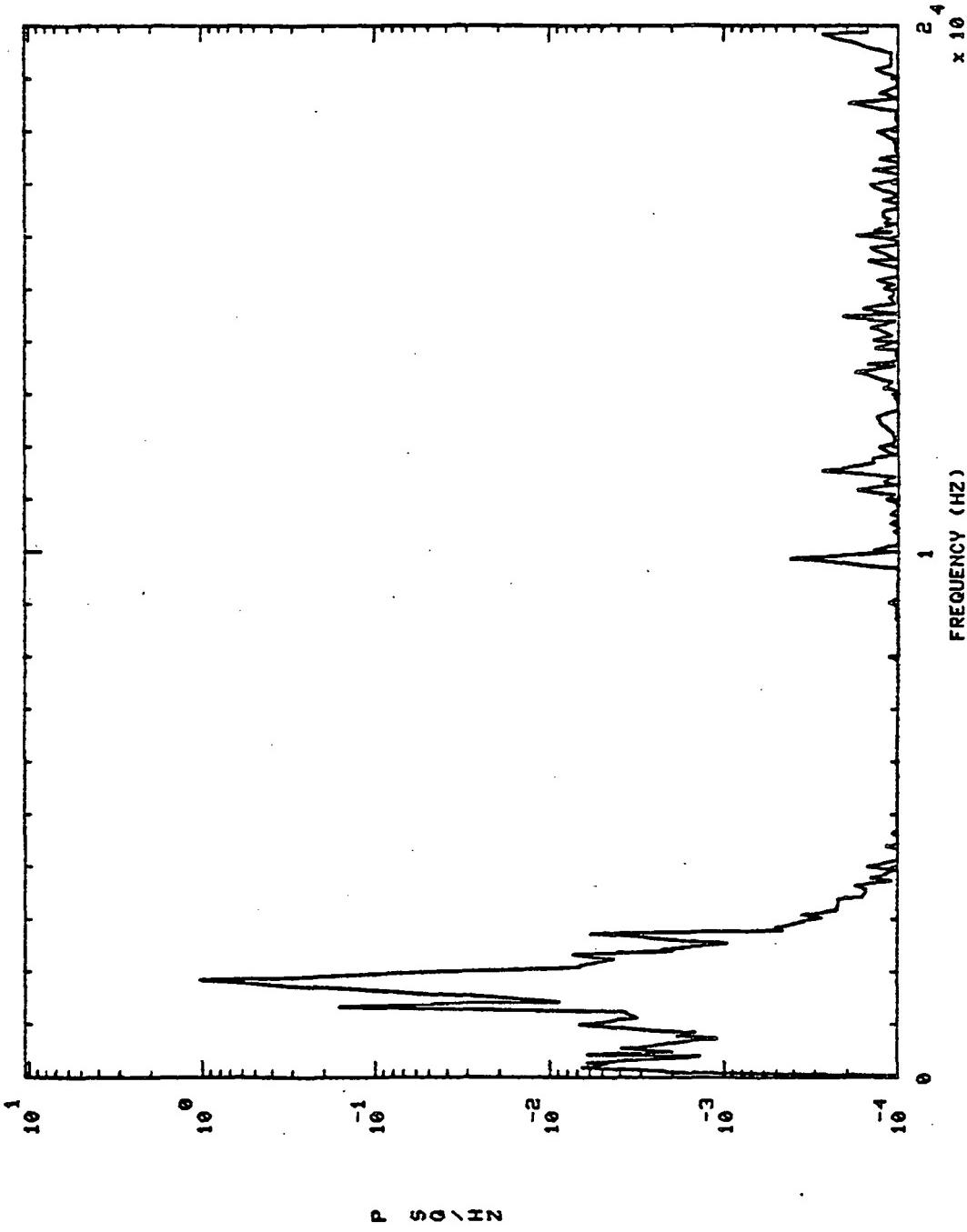
901305 FPB FUEL MAN PR

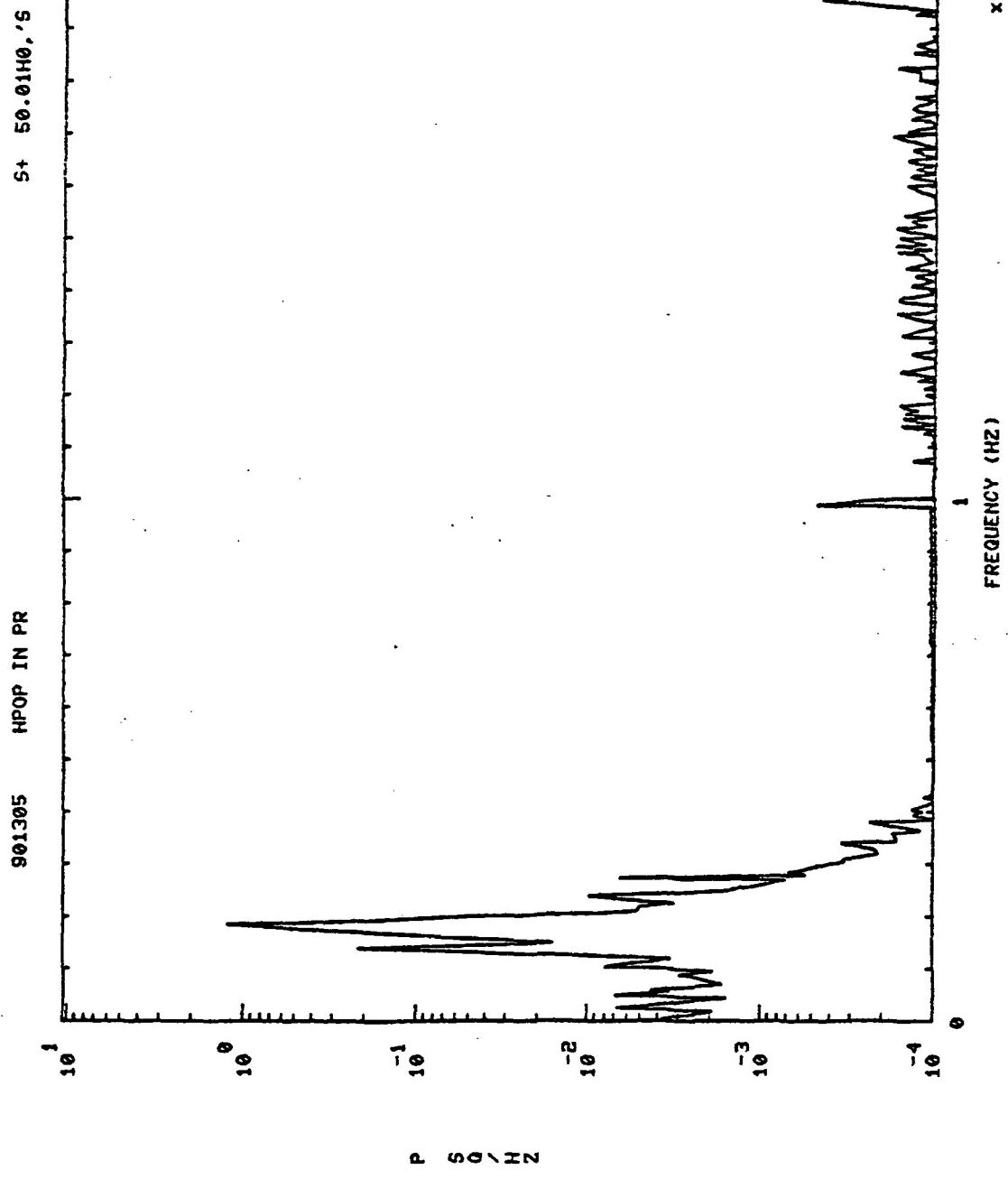




S+ 25.01H0.'S

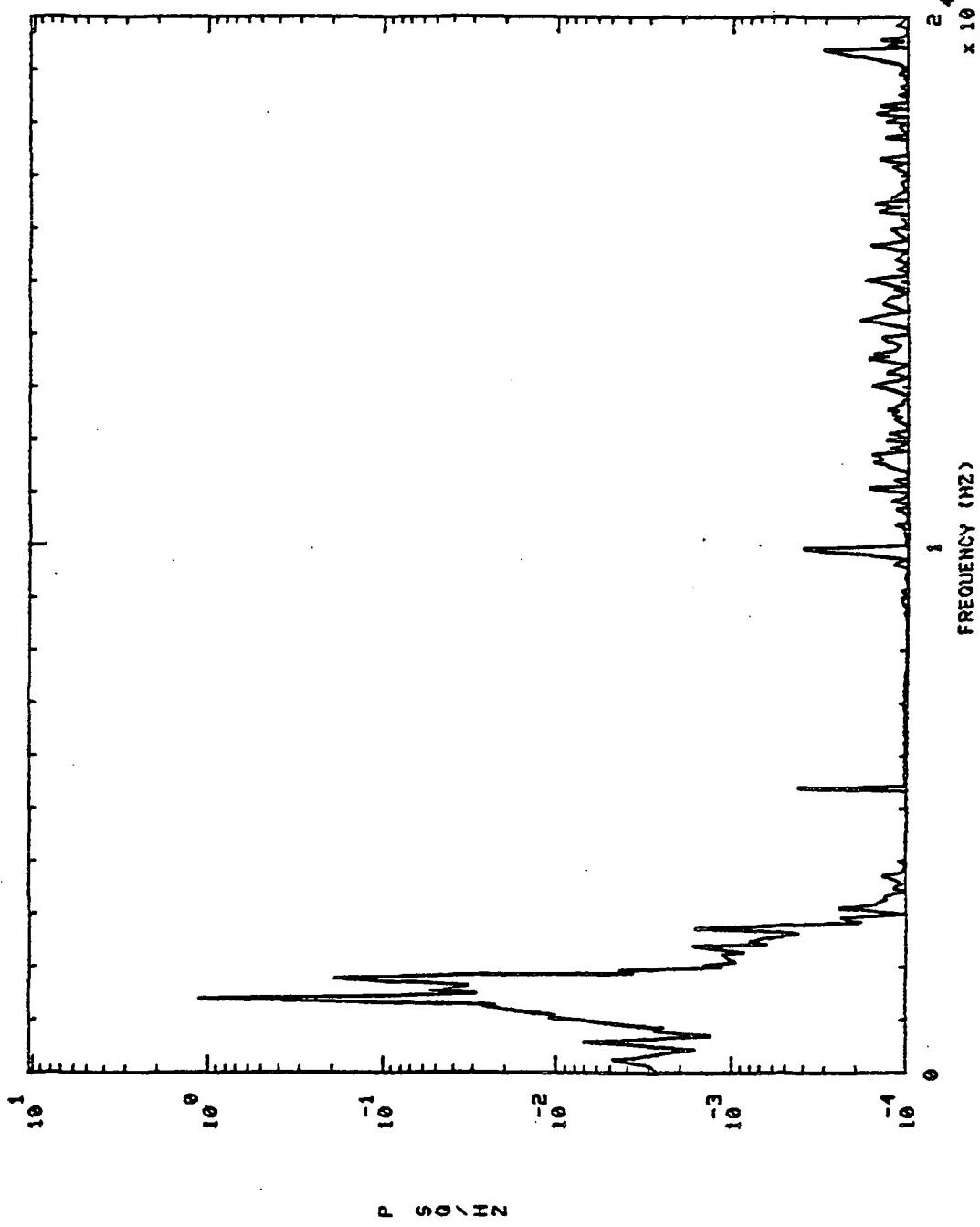
901305 HP0P IN PR

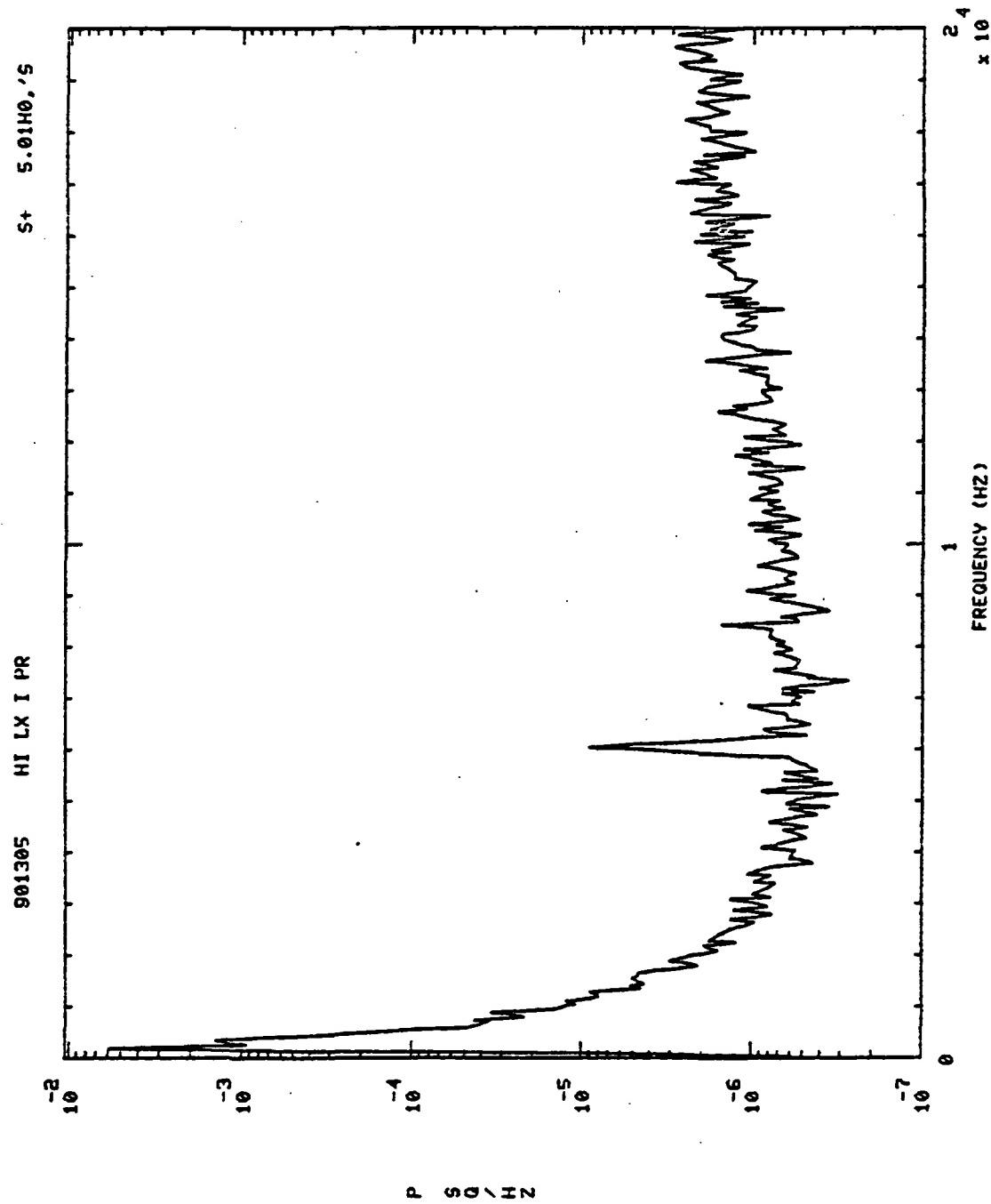




S+ 75.01H0.'S

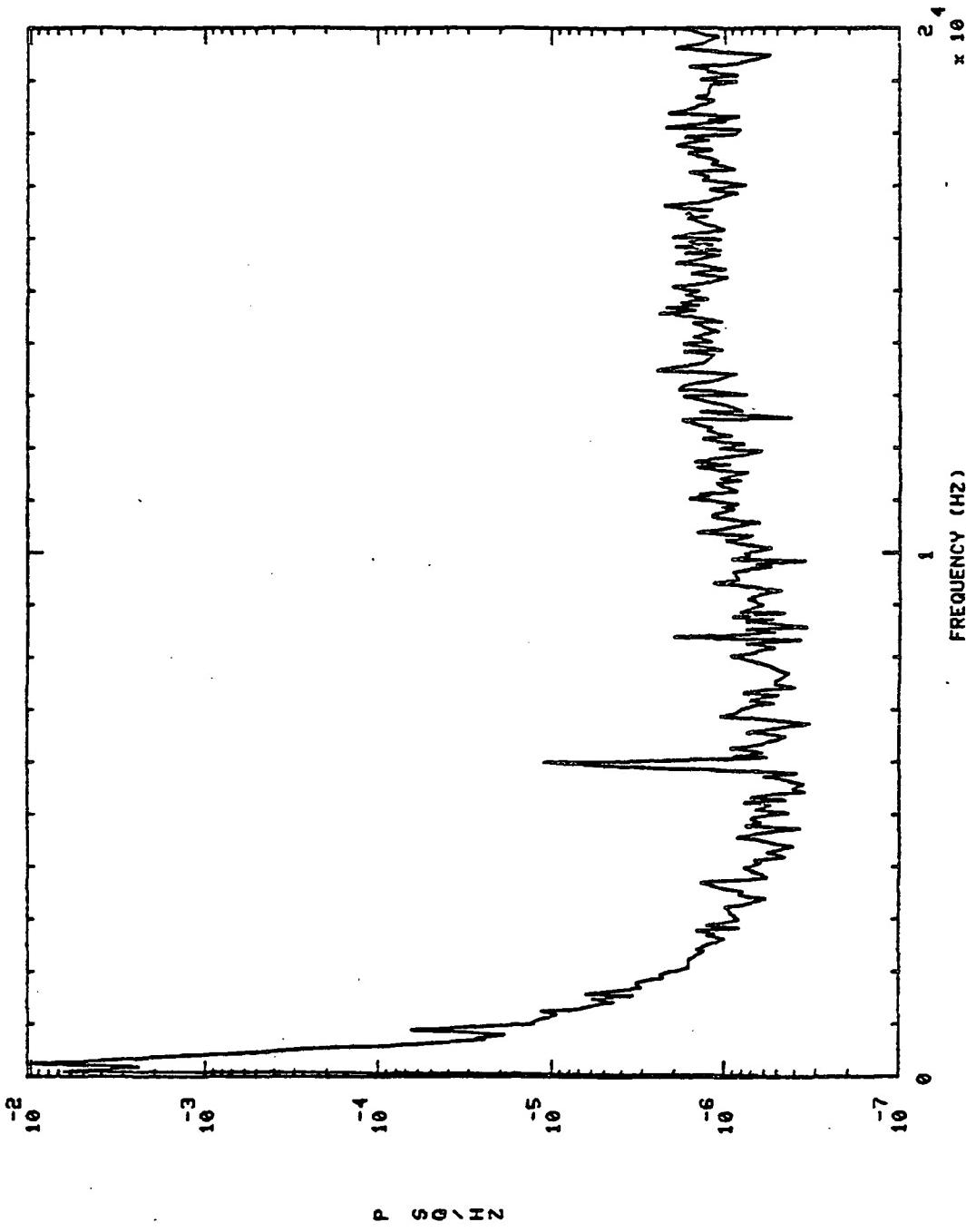
901305 HPOP IN PR



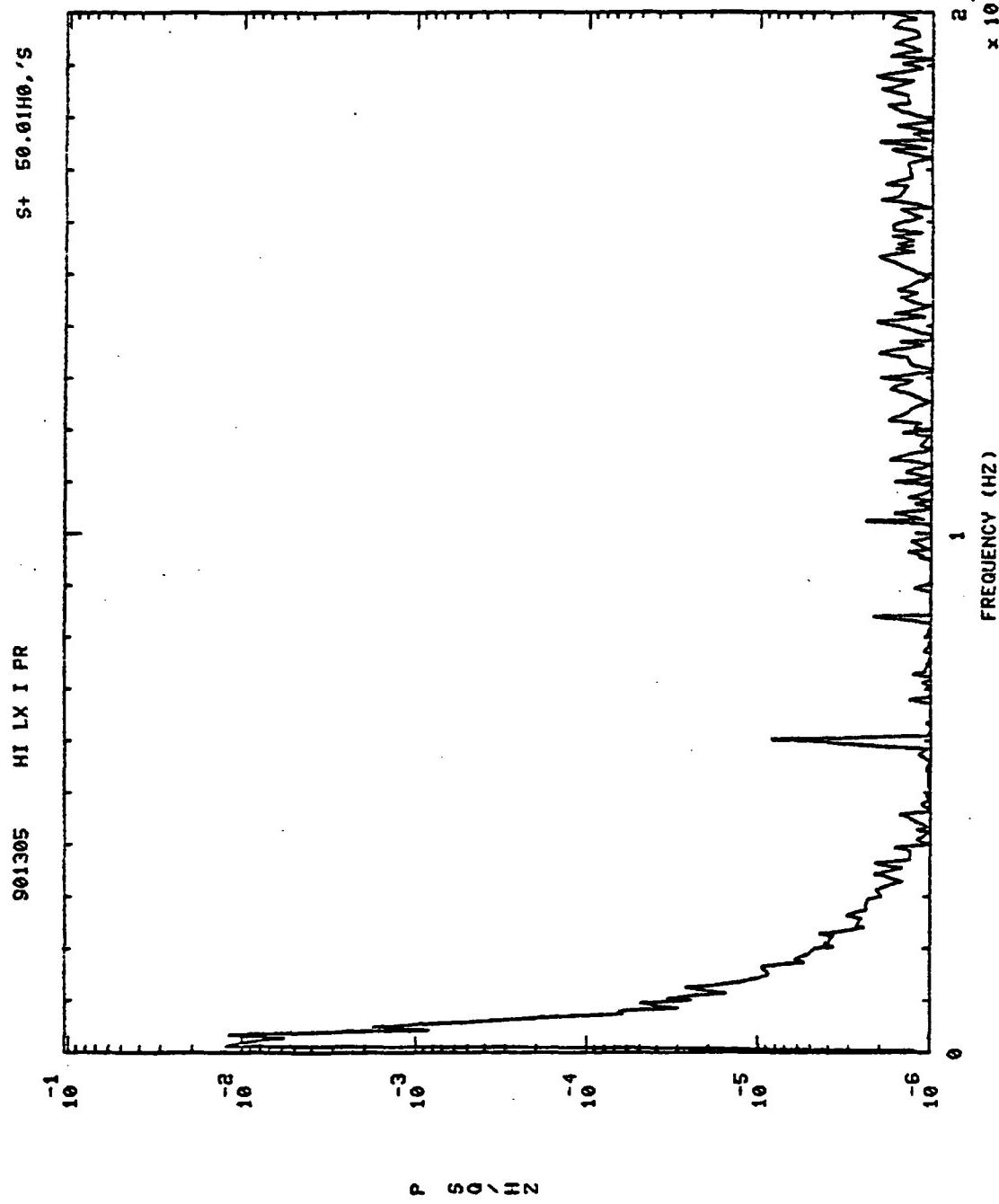


5+ 25.01100, S

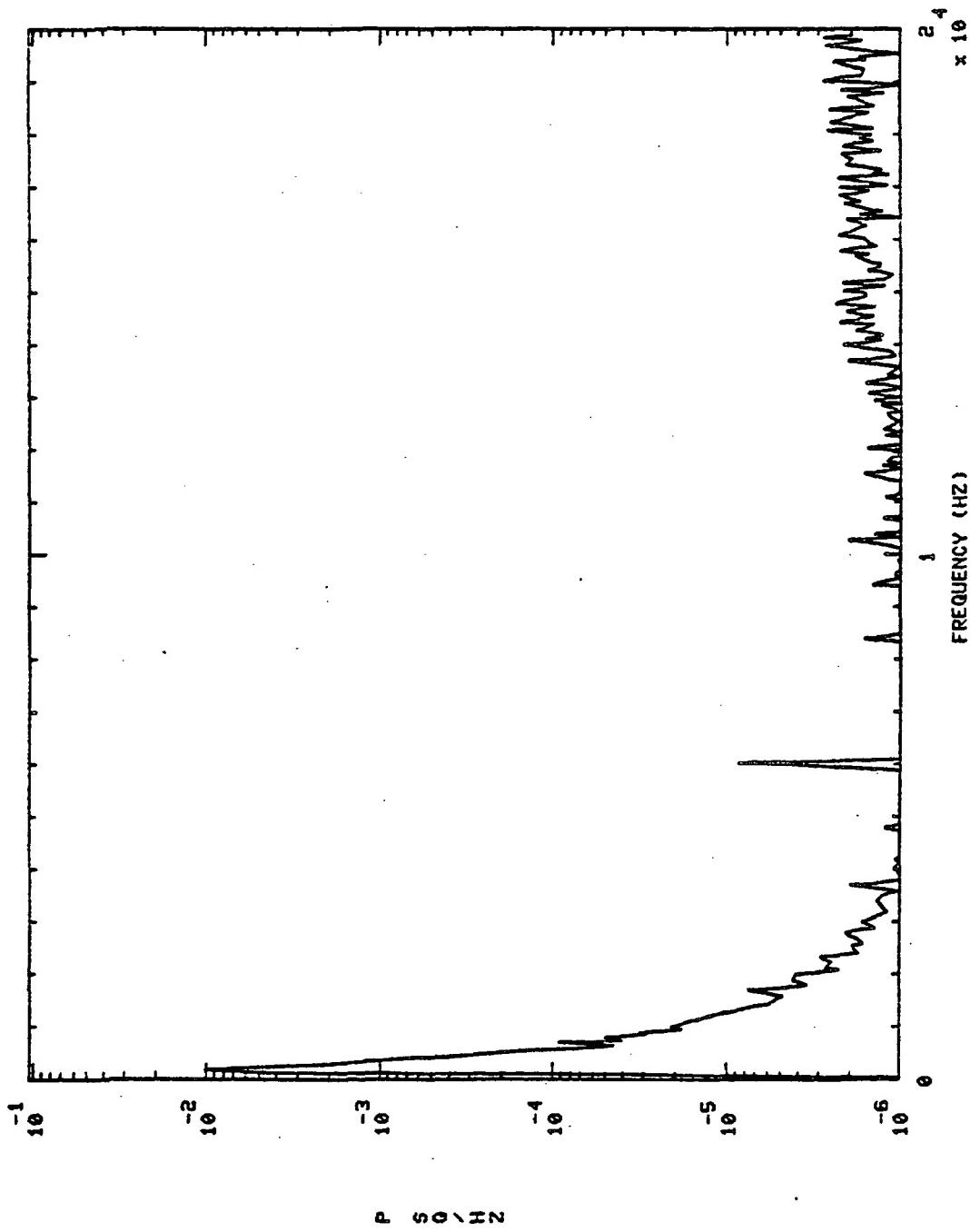
901305 HILX1PR

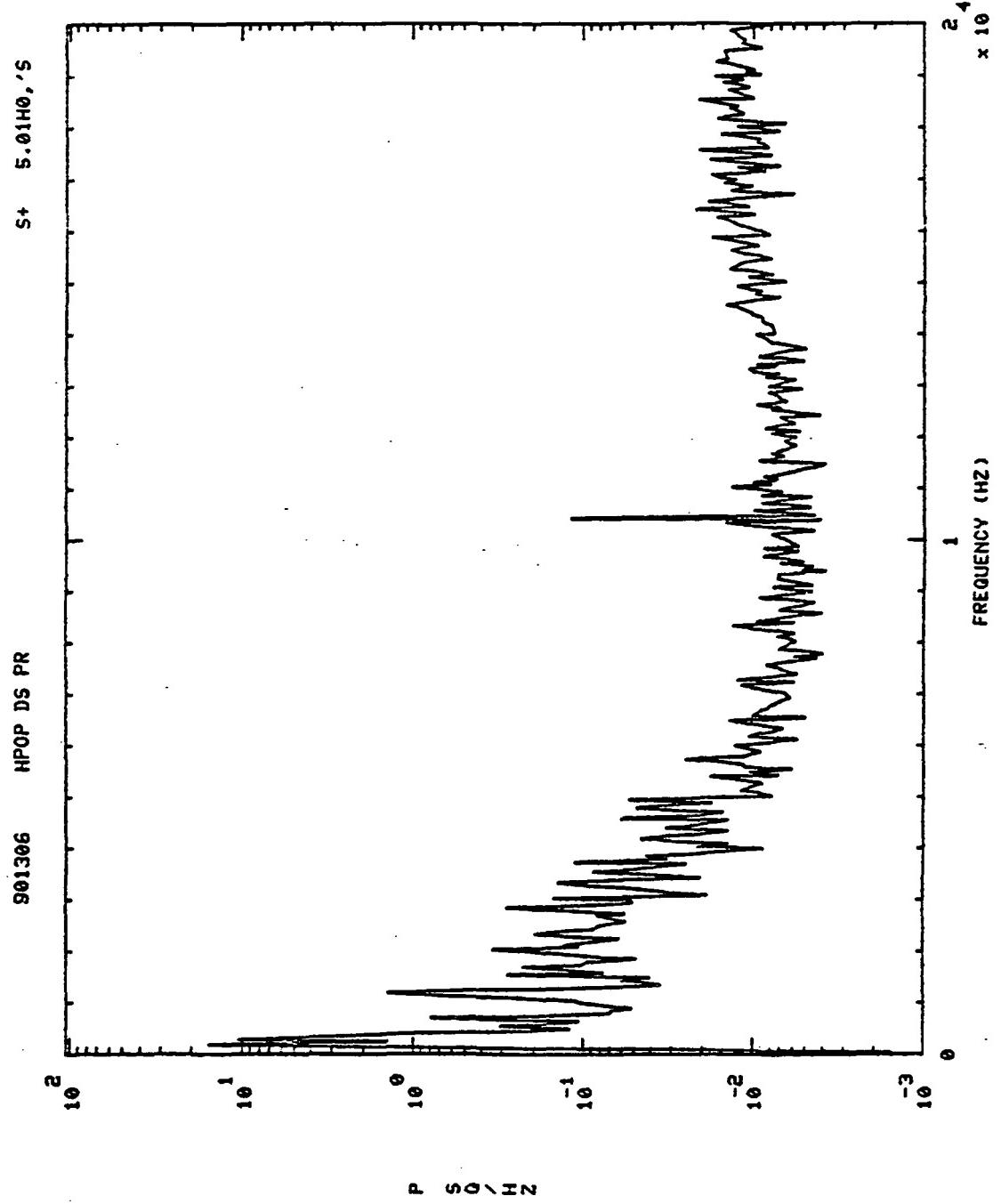


P S ZH/CS



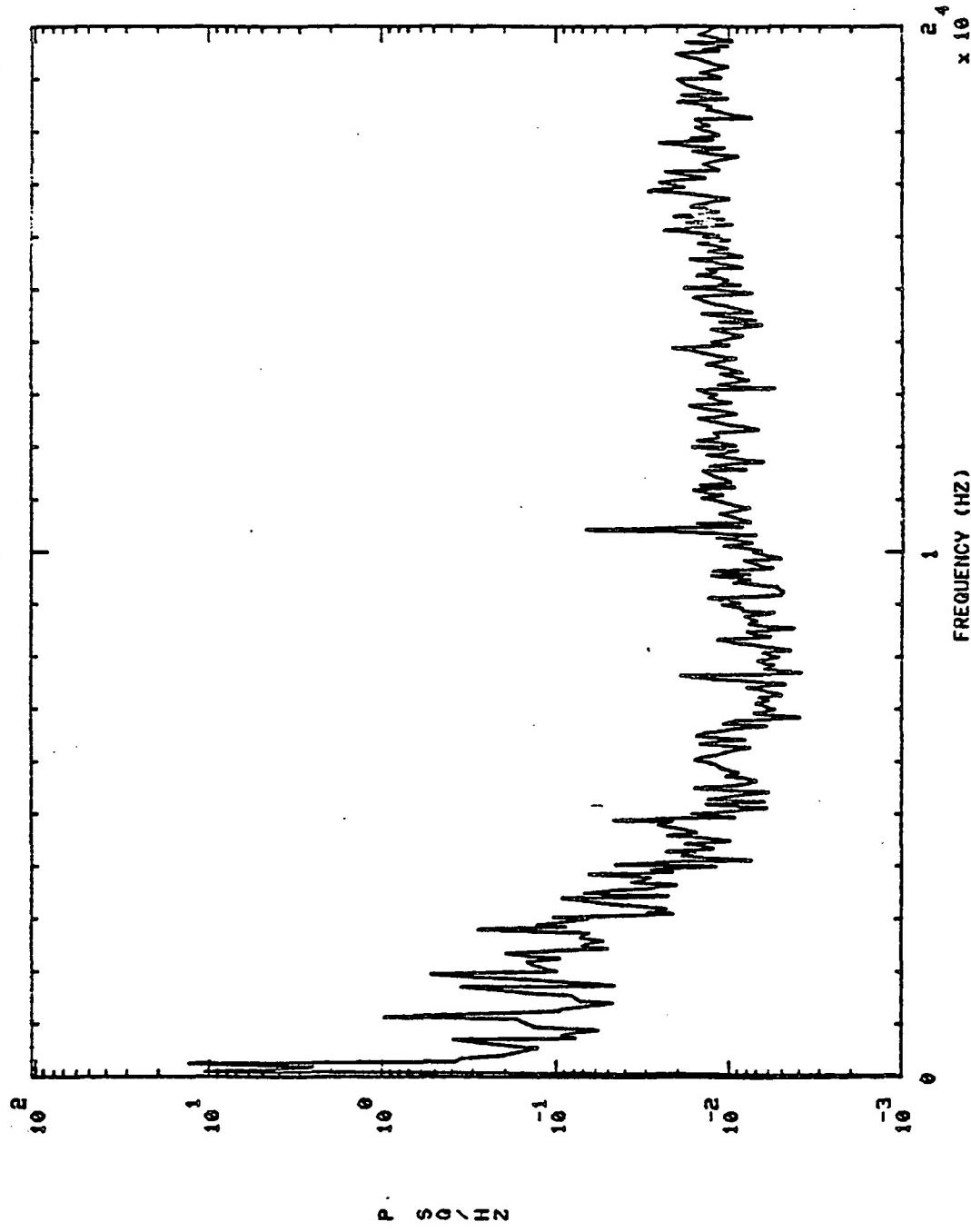
901305 HI LX I PR S+ 75.01H0, 'S

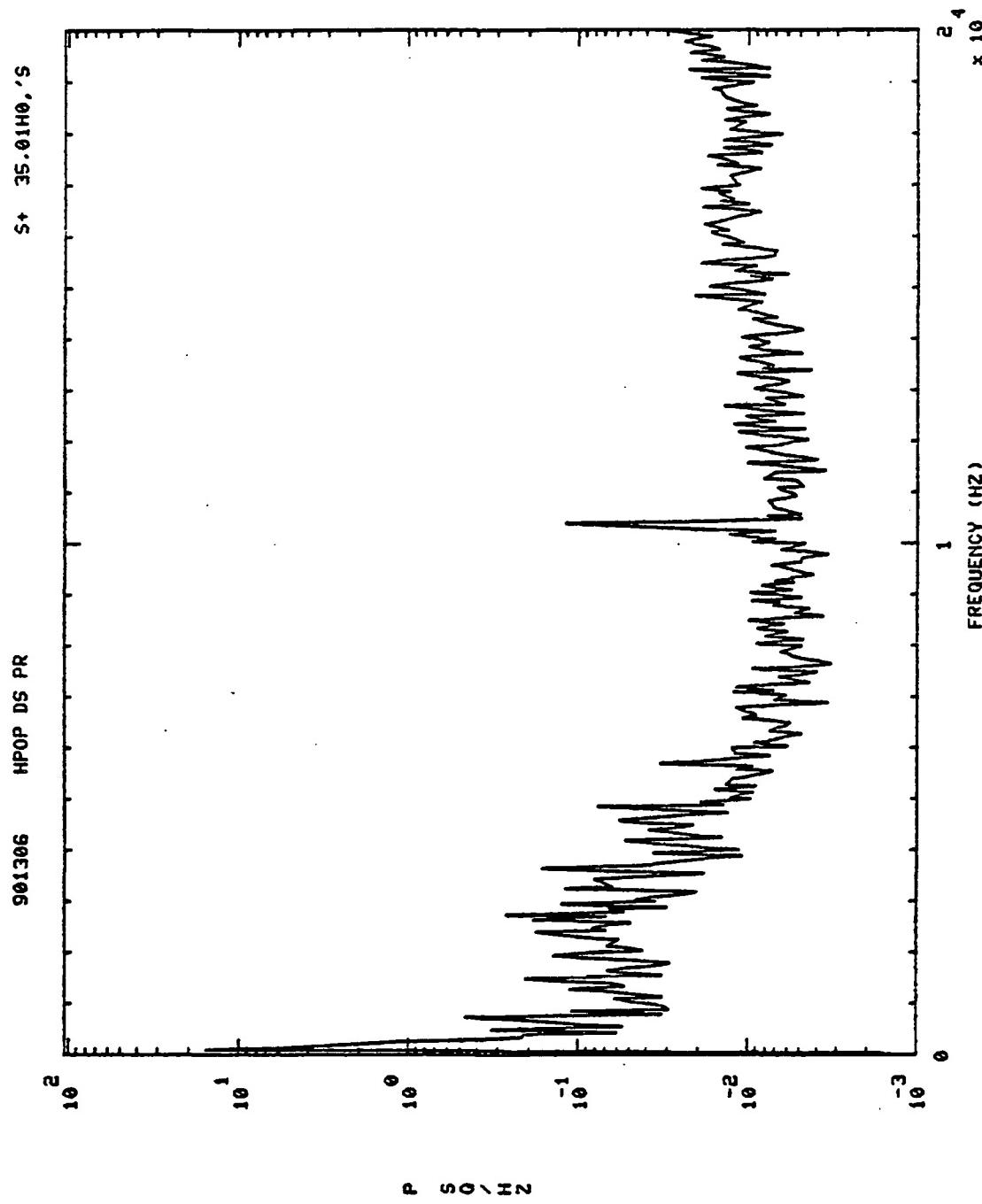




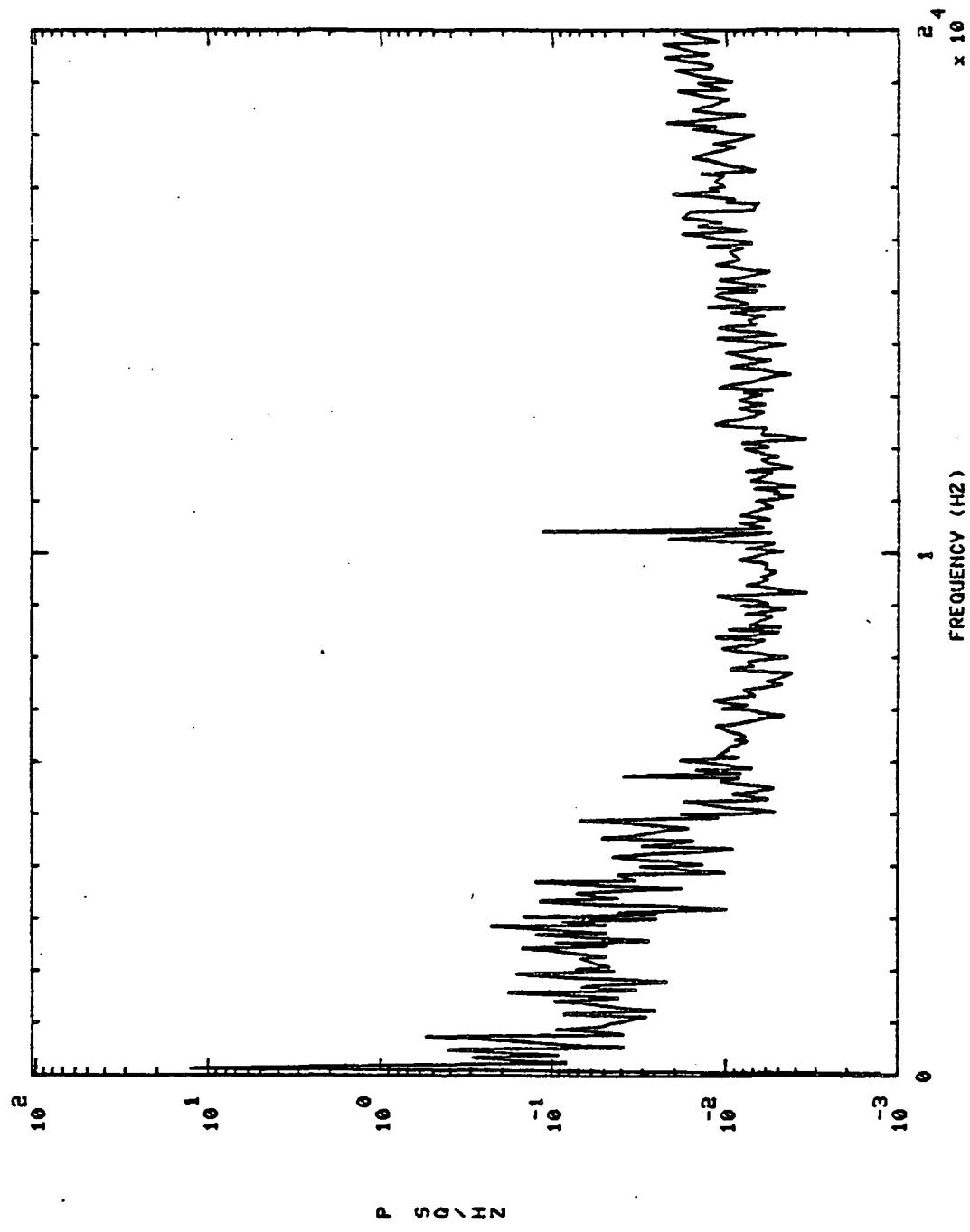
901306 HPOP DS PR

Sr 6.01Hz, s



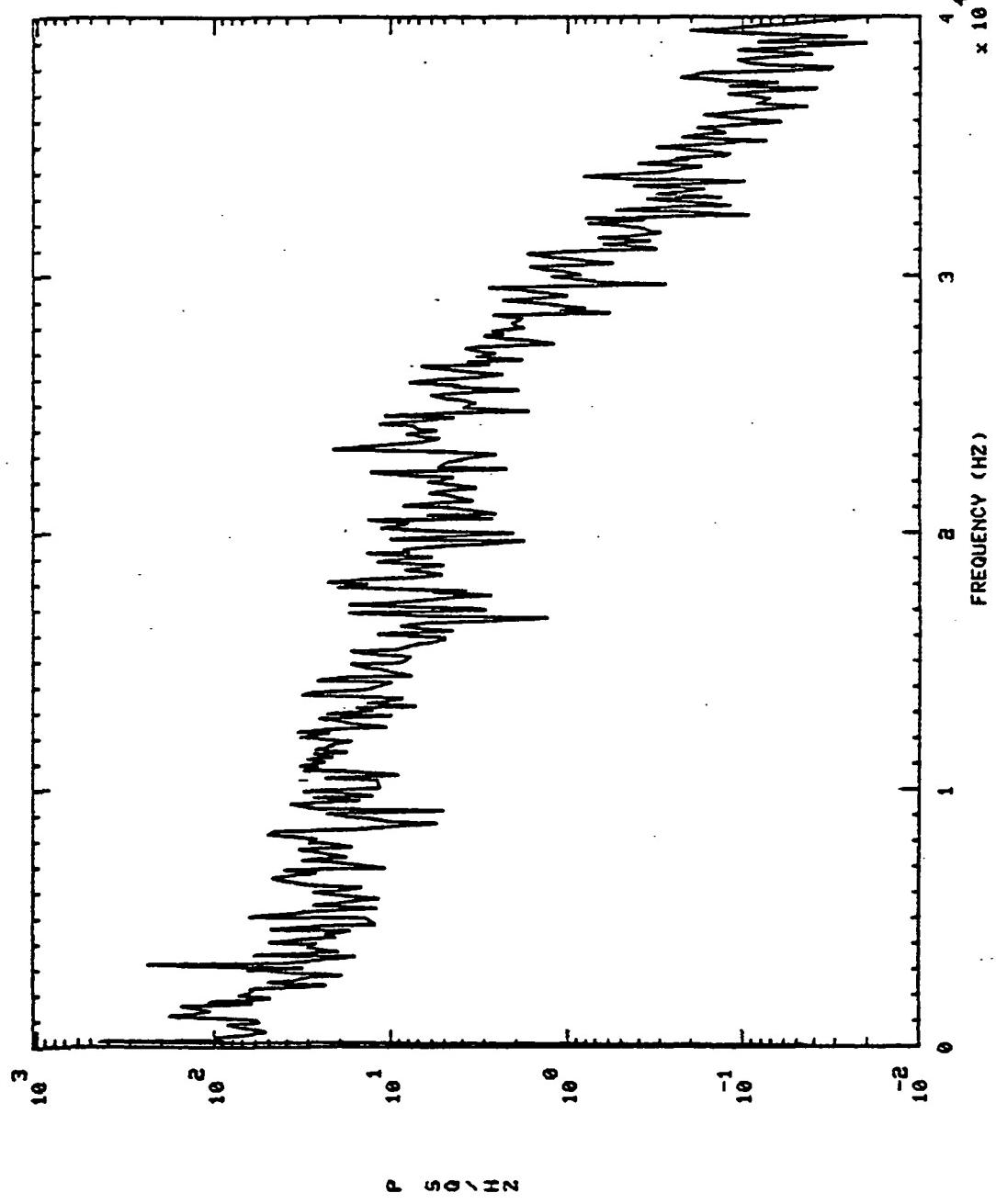


901306 HPOP DS PR $\zeta + 70.01\zeta_0, \zeta$



901306 MCC HOT GAS IN PR

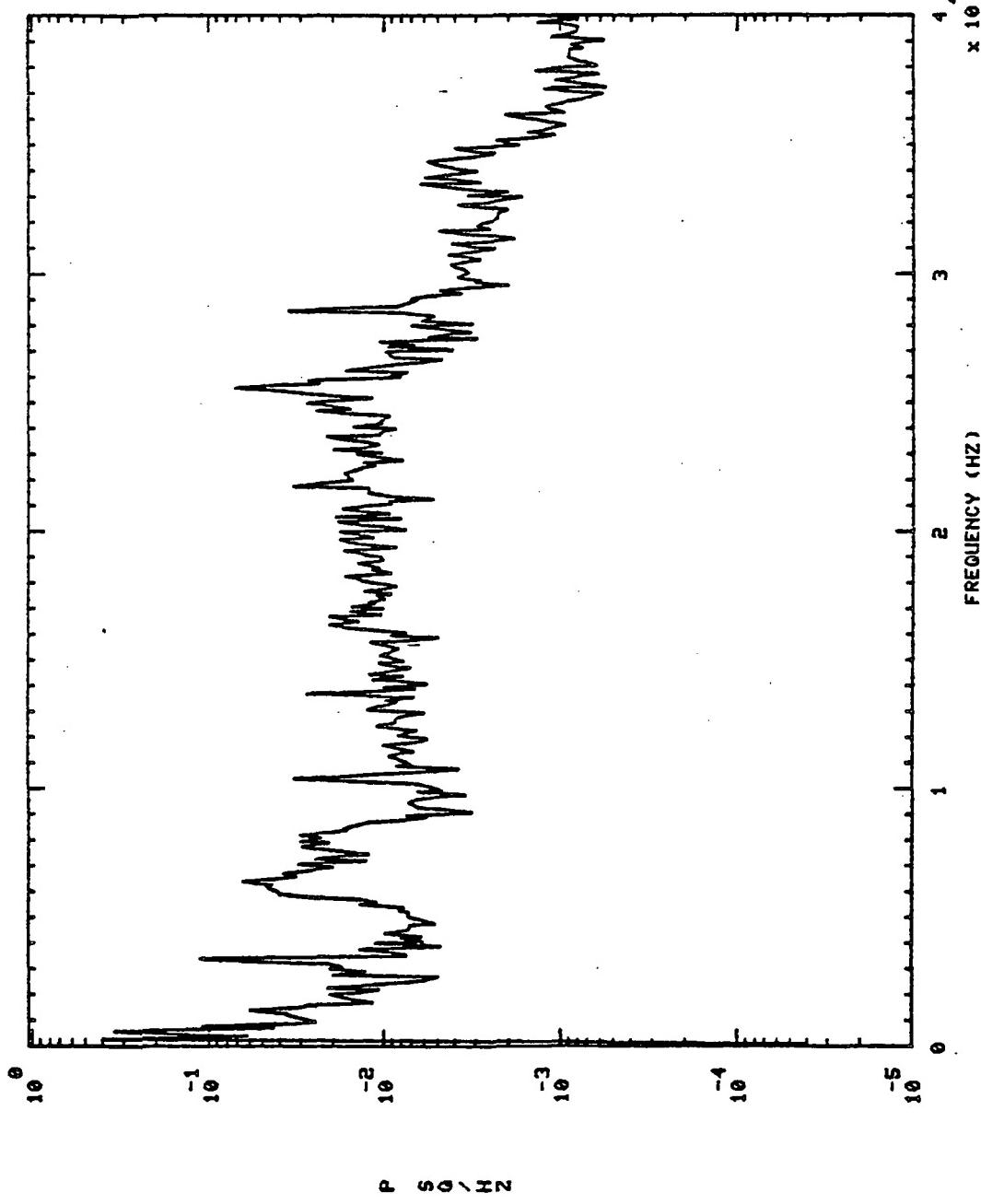
S+ 5.01H0, 'S



S+ 20.01Hz, s

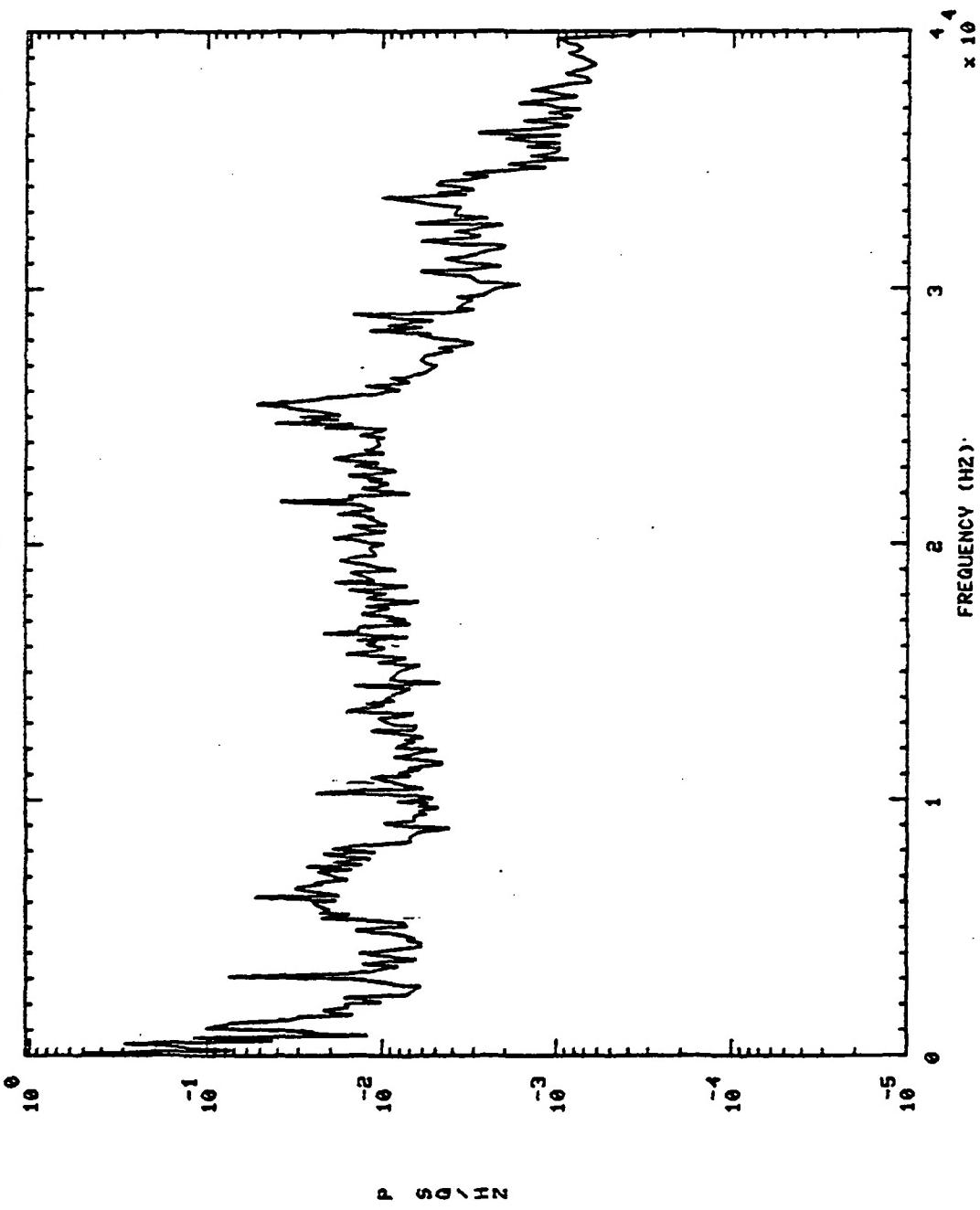
MCC HOT GAS IN PR

901306



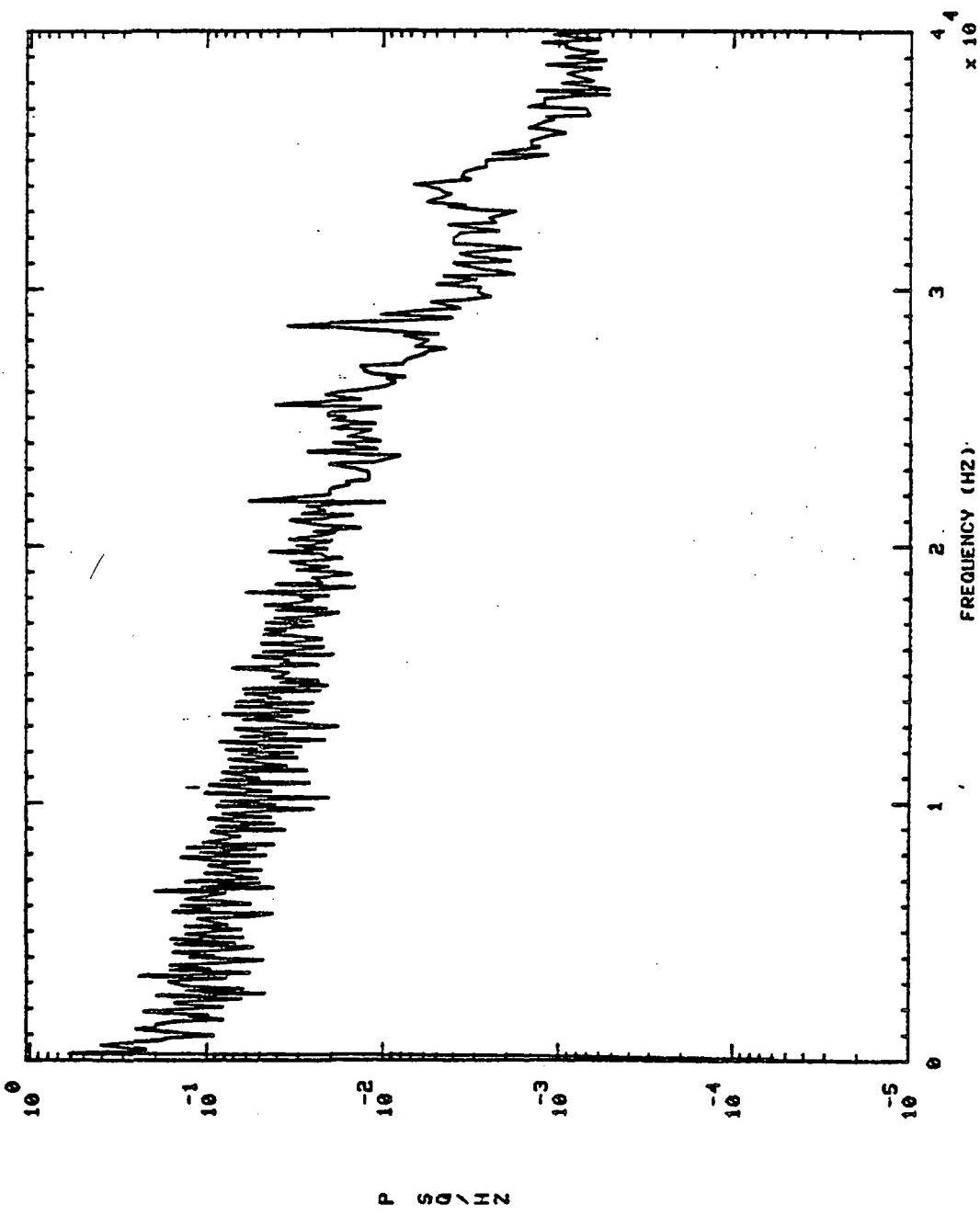
901306 MCC HOT GAS IN PR

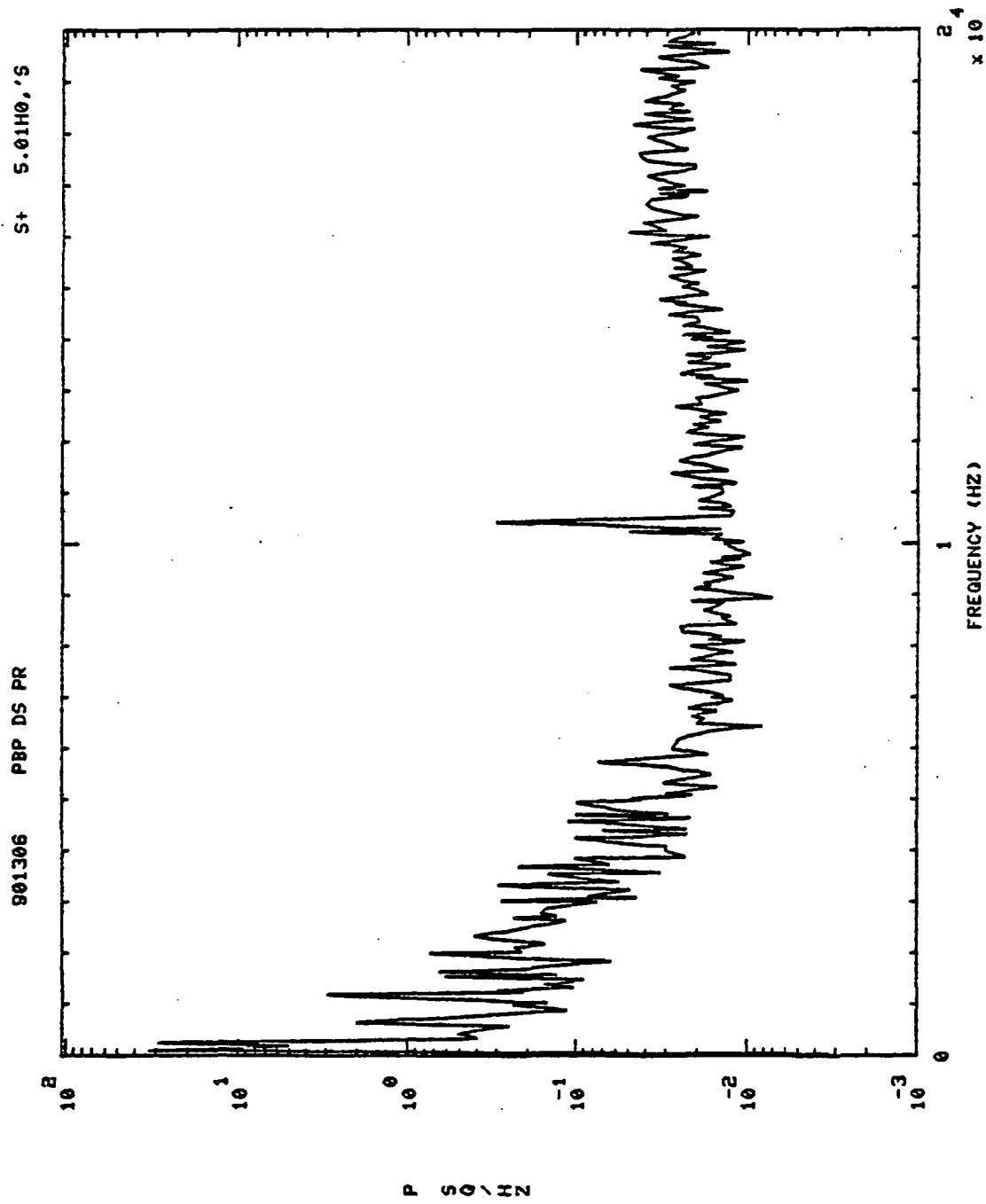
S+ 50.01H0./S



S+ 75.01H0, 'S

901306 MCC HOT GAS IN PR

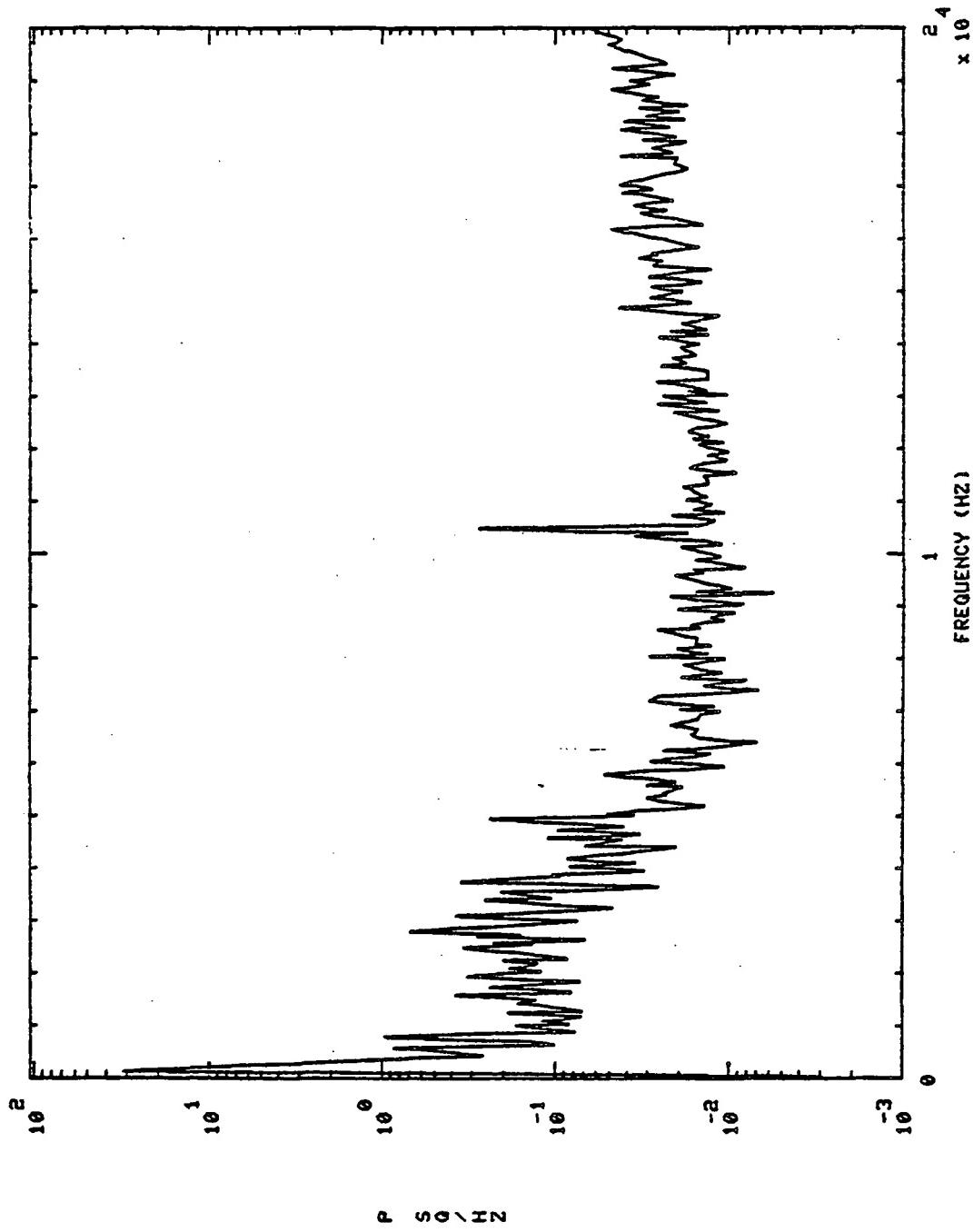


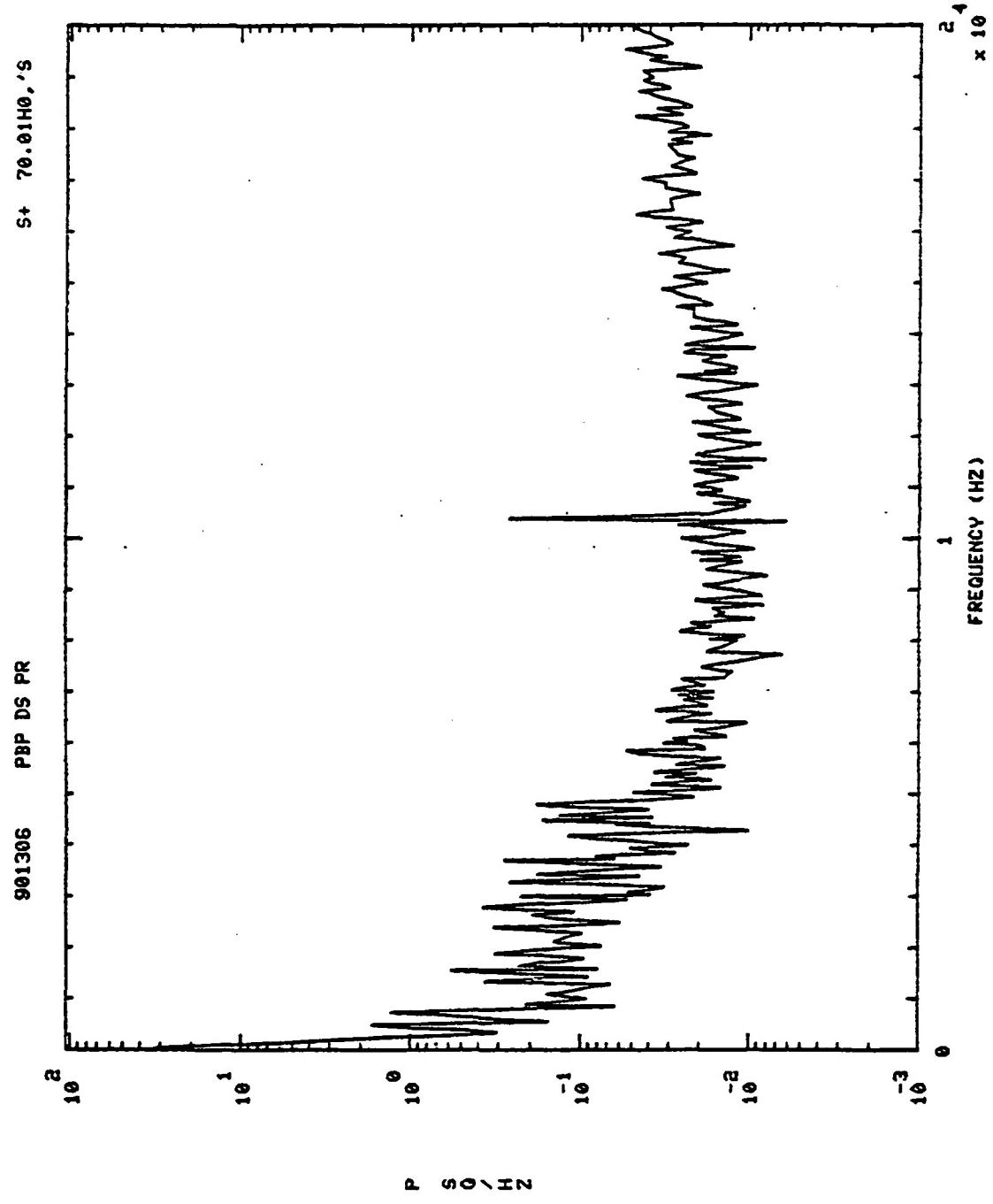


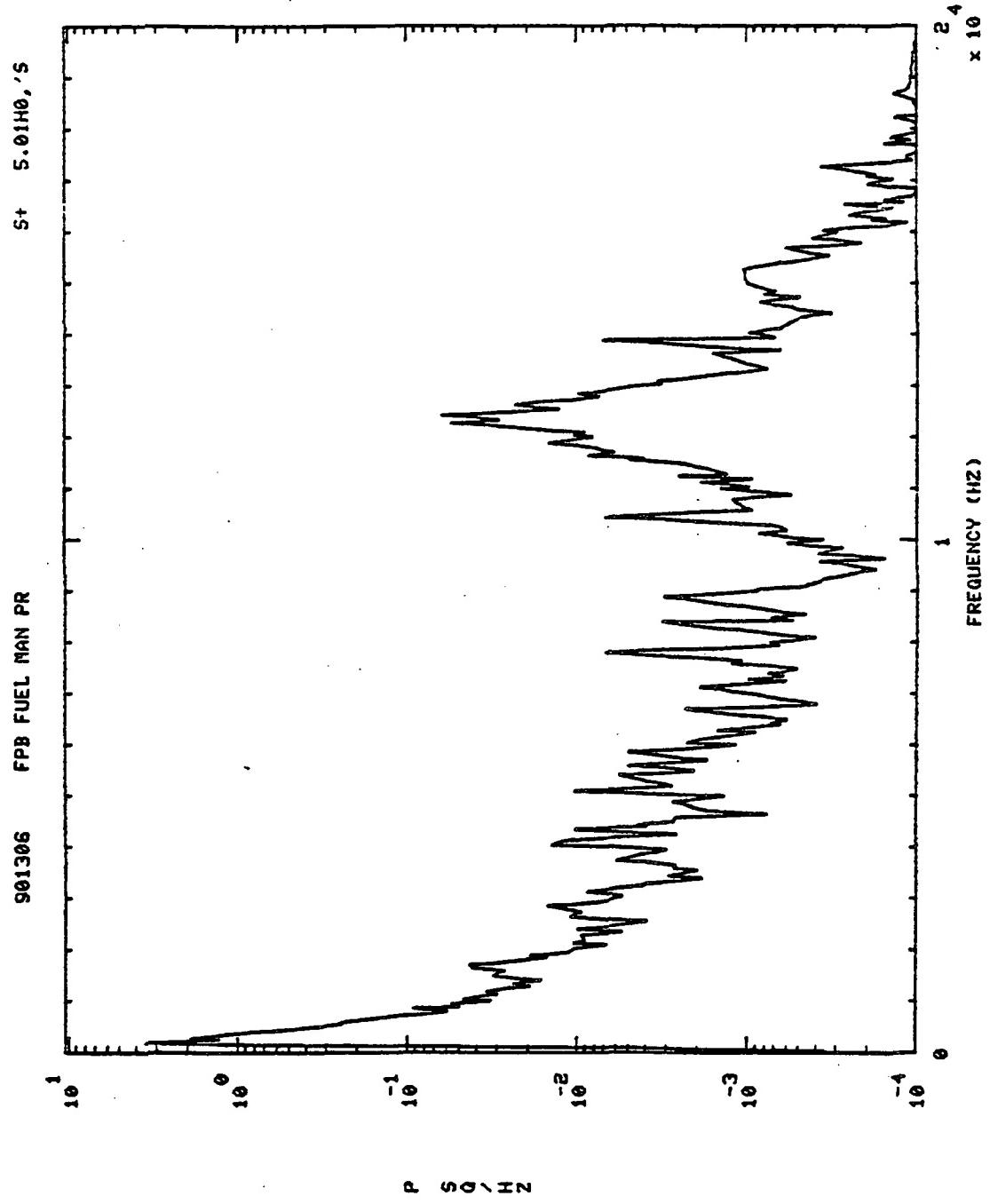
901306

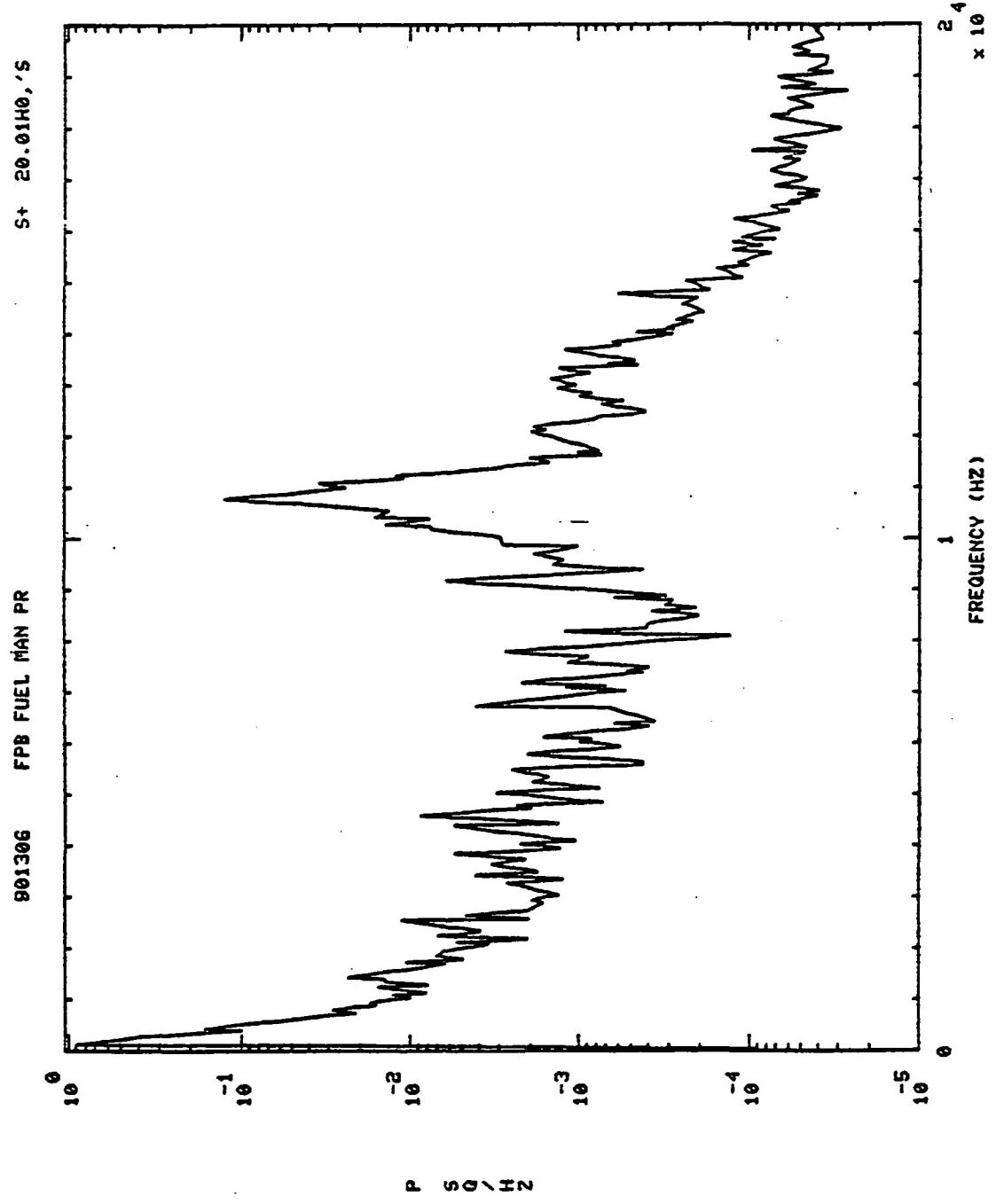
PBP DS PR

S+ 35.01H0, 'S









S+ 50.01Hz, 'S

901306 FPB FUEL MAN PR

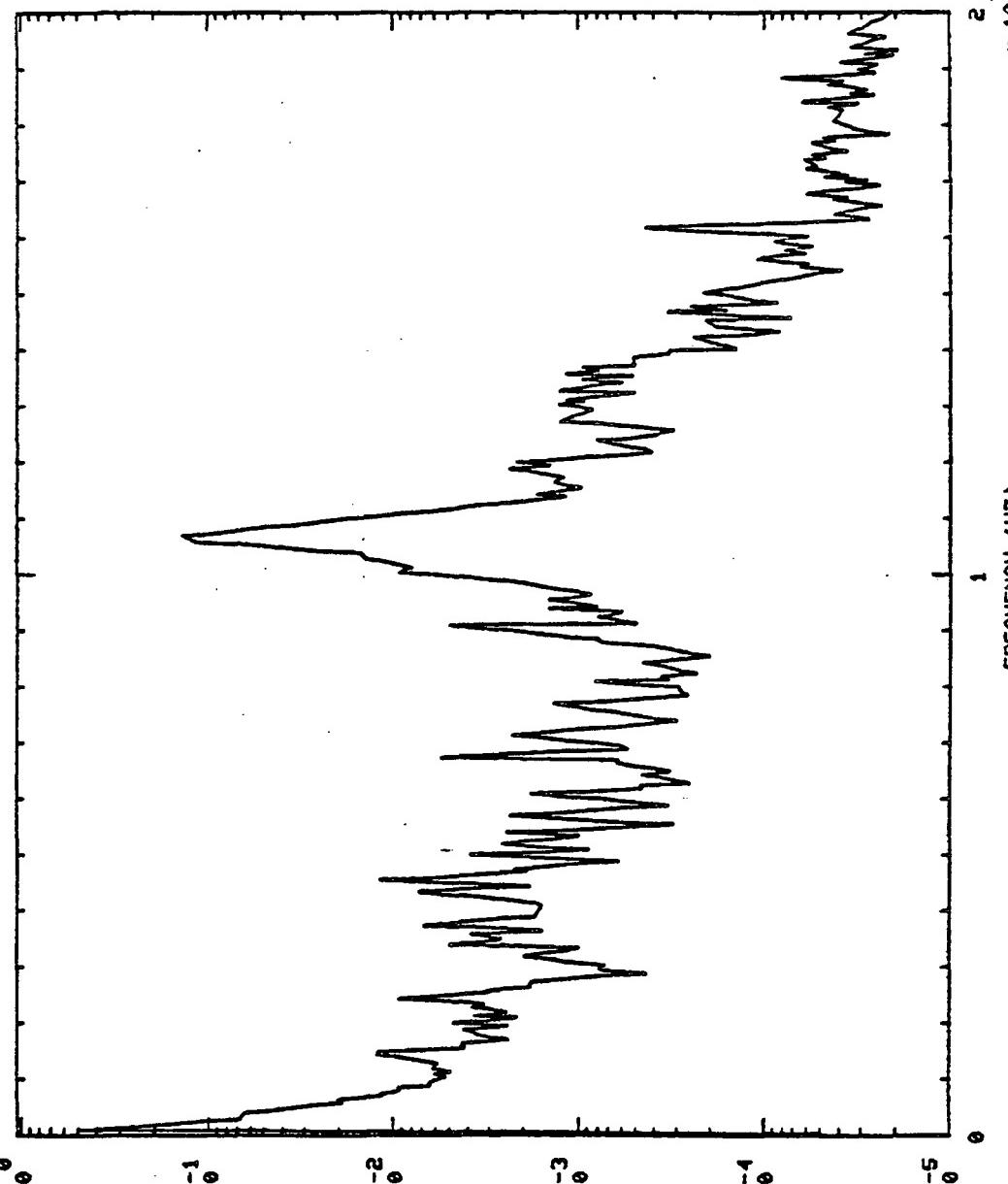
10^6

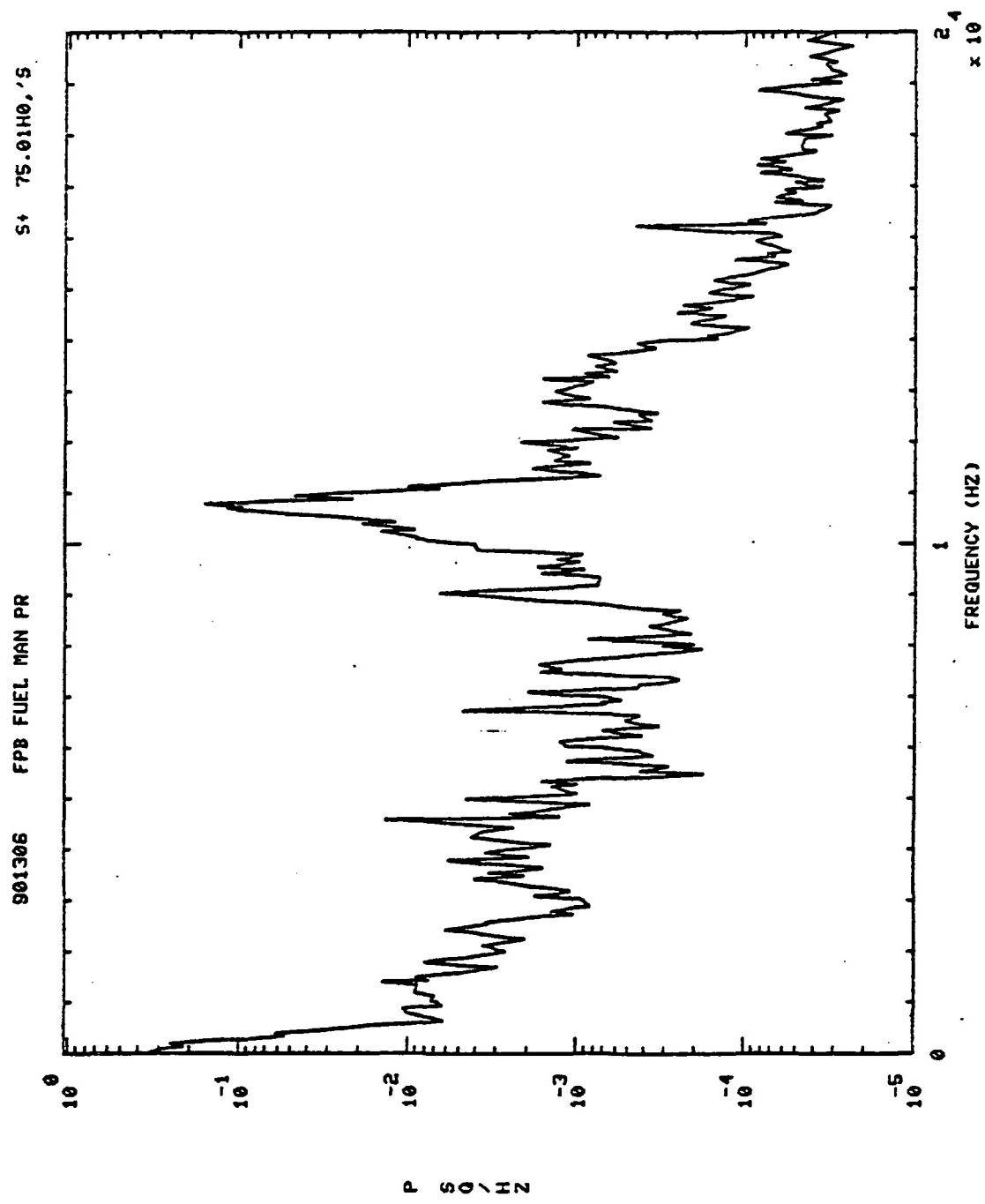
P S/G/HZ

2^4

$\times 10$

1
FREQUENCY (HZ)

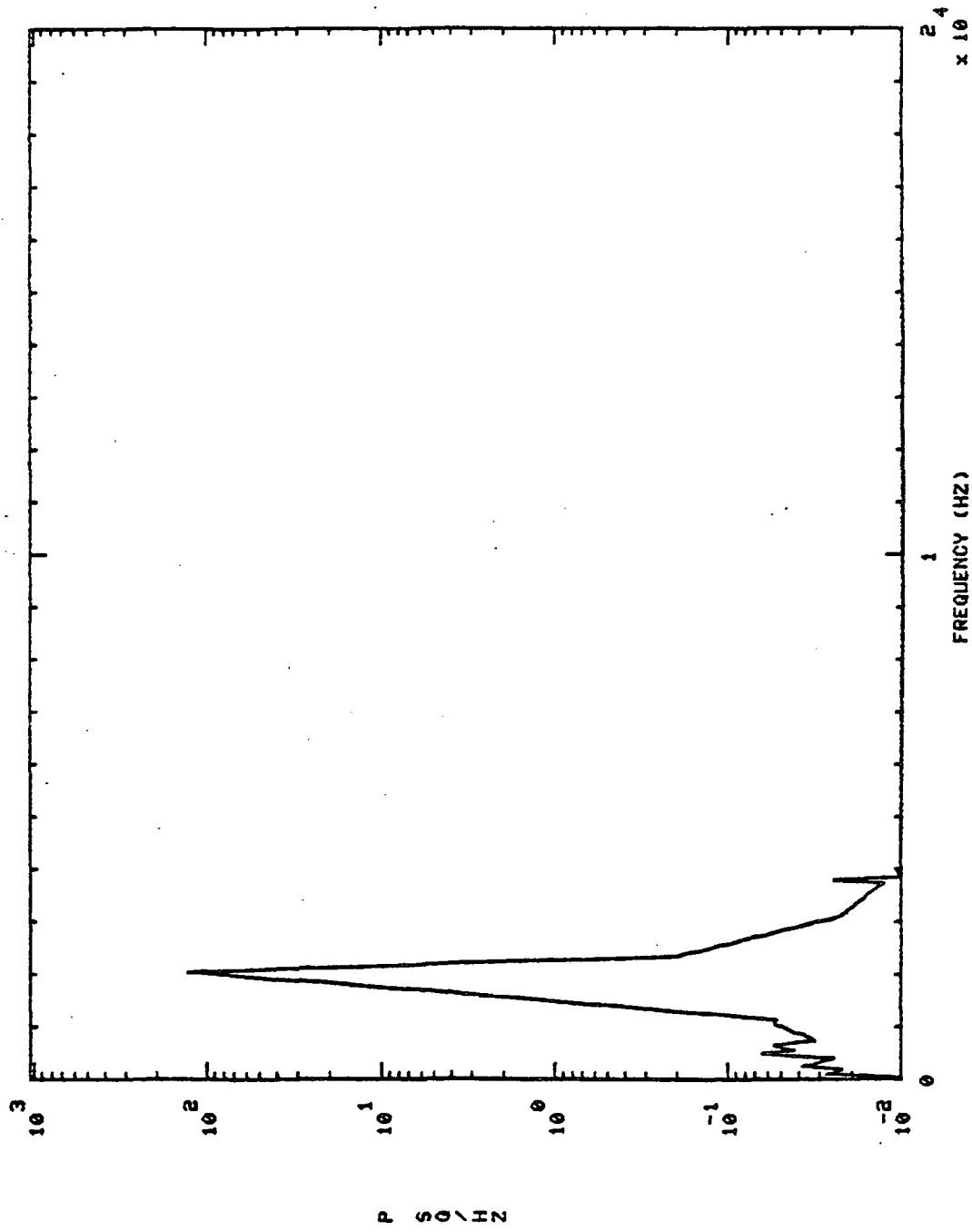


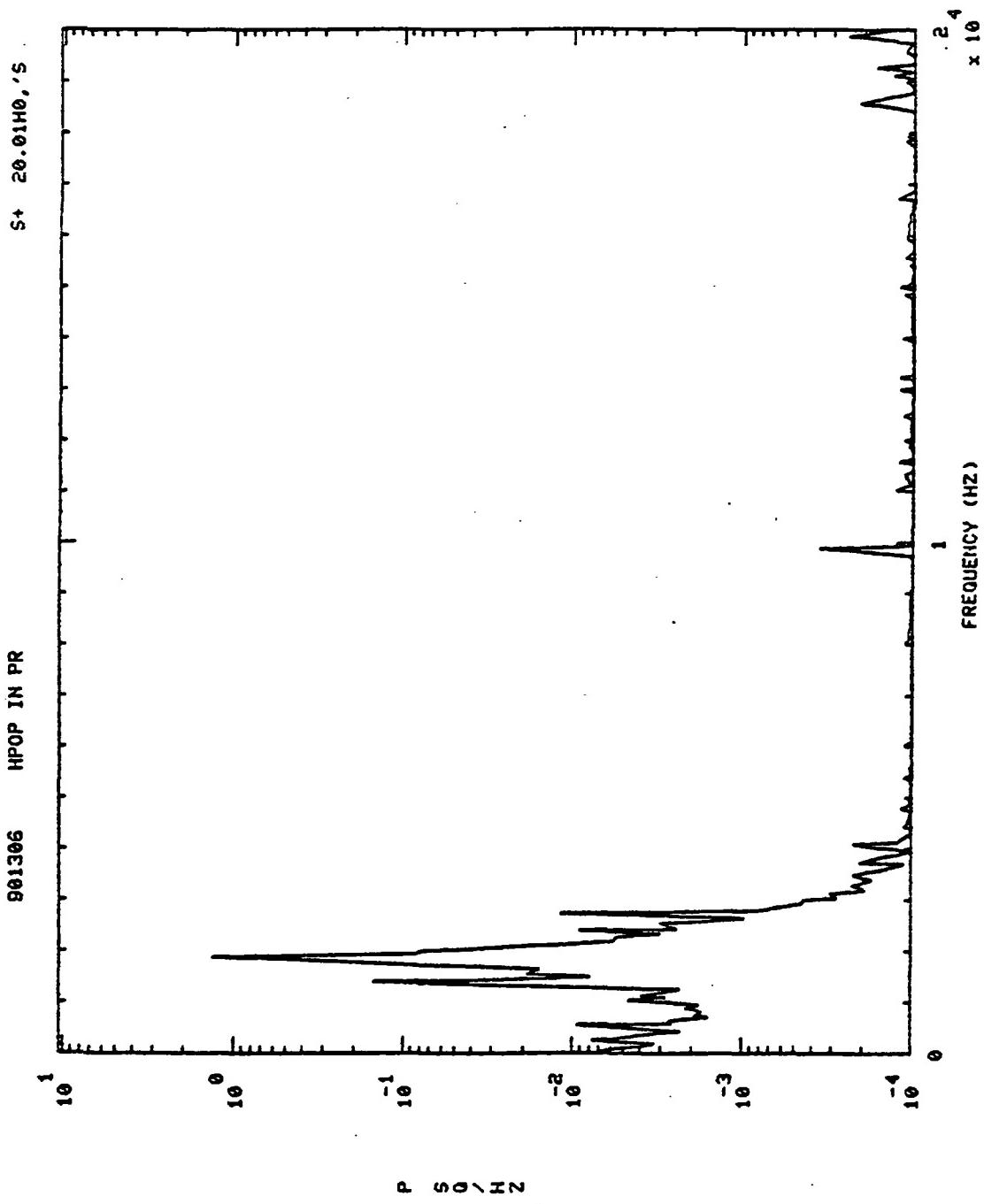


901306

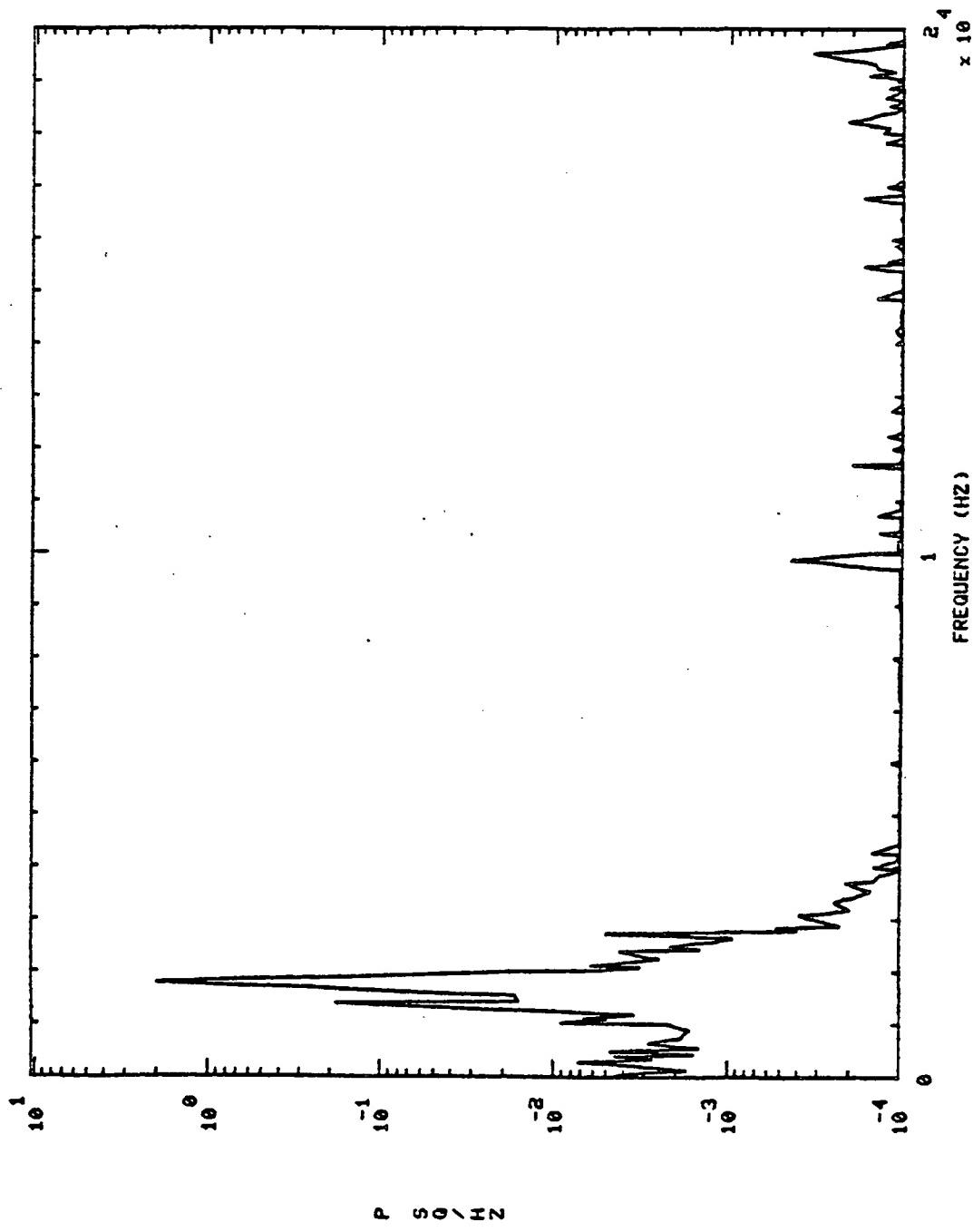
St 5.01HQ0, '6

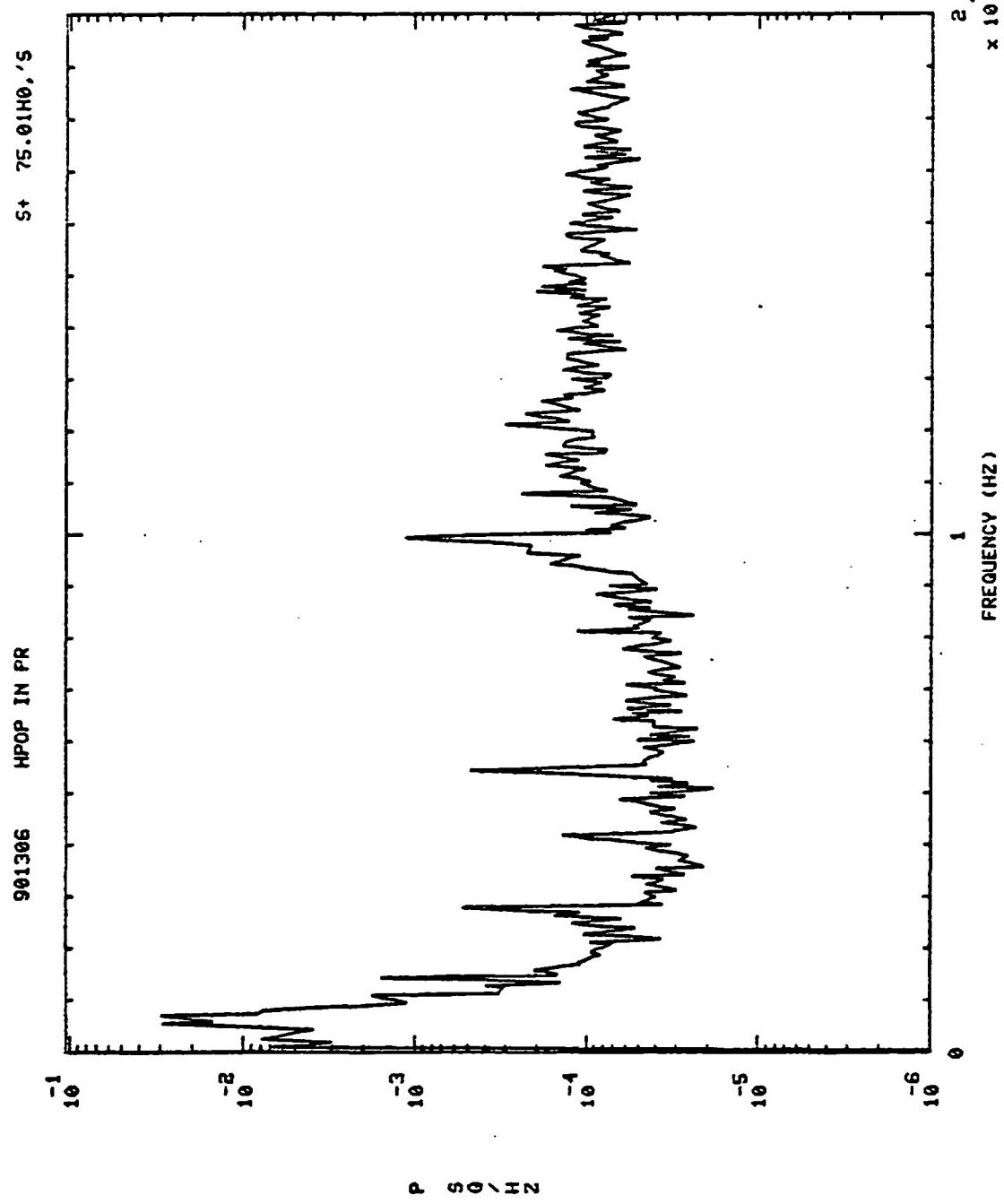
HPOP IN PR





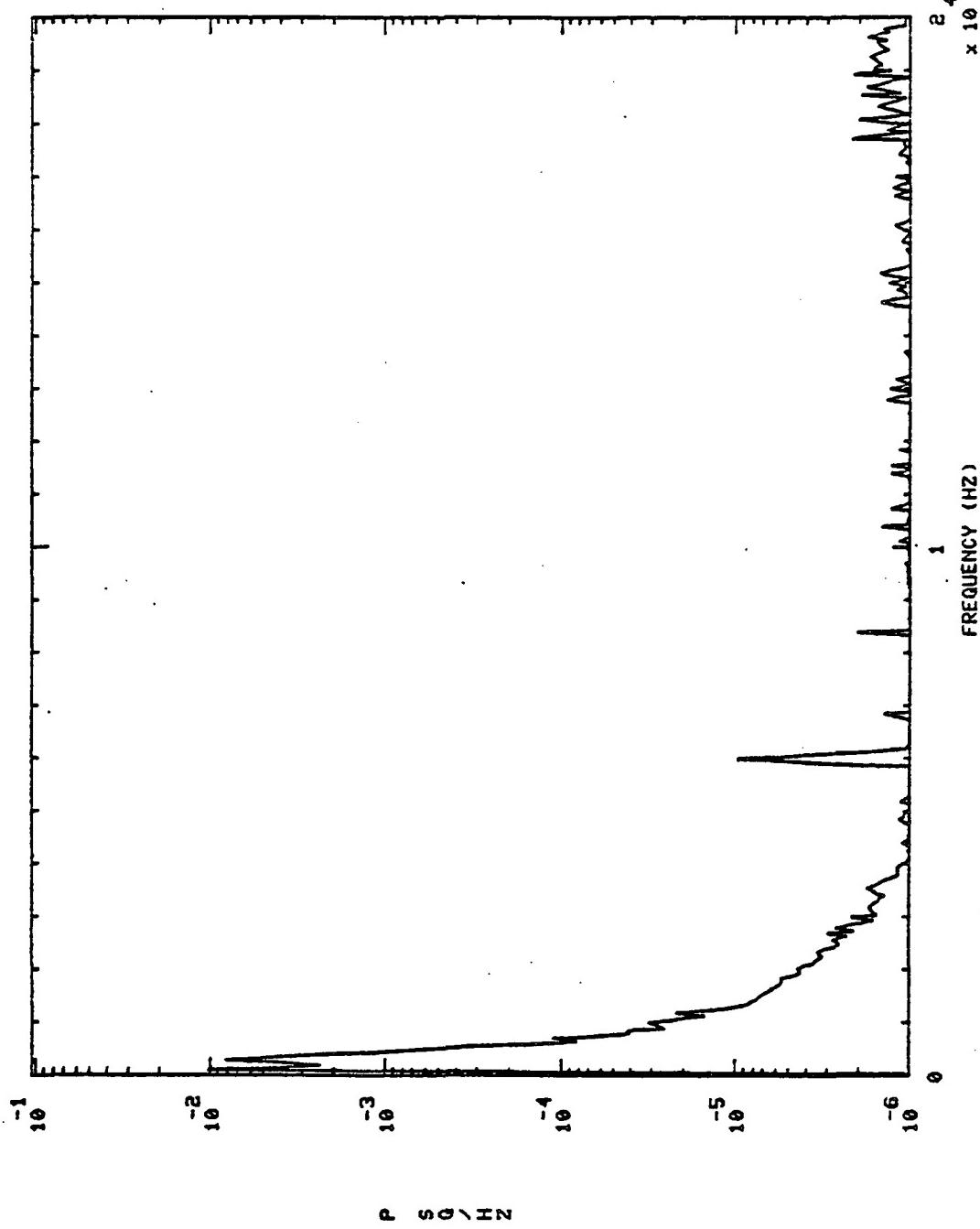
901306 HPOP IN PR S+ 50.01Hz, 'S

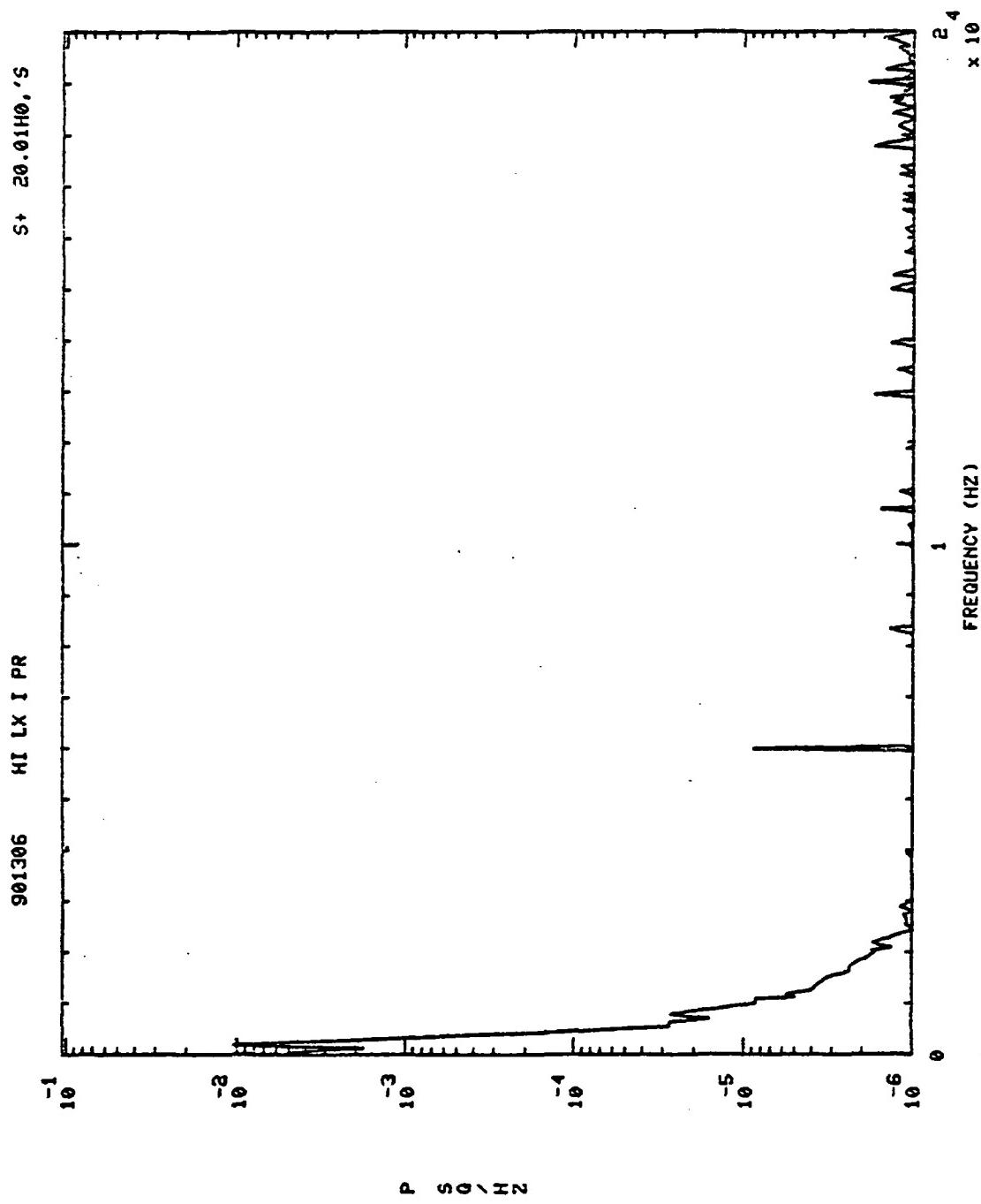


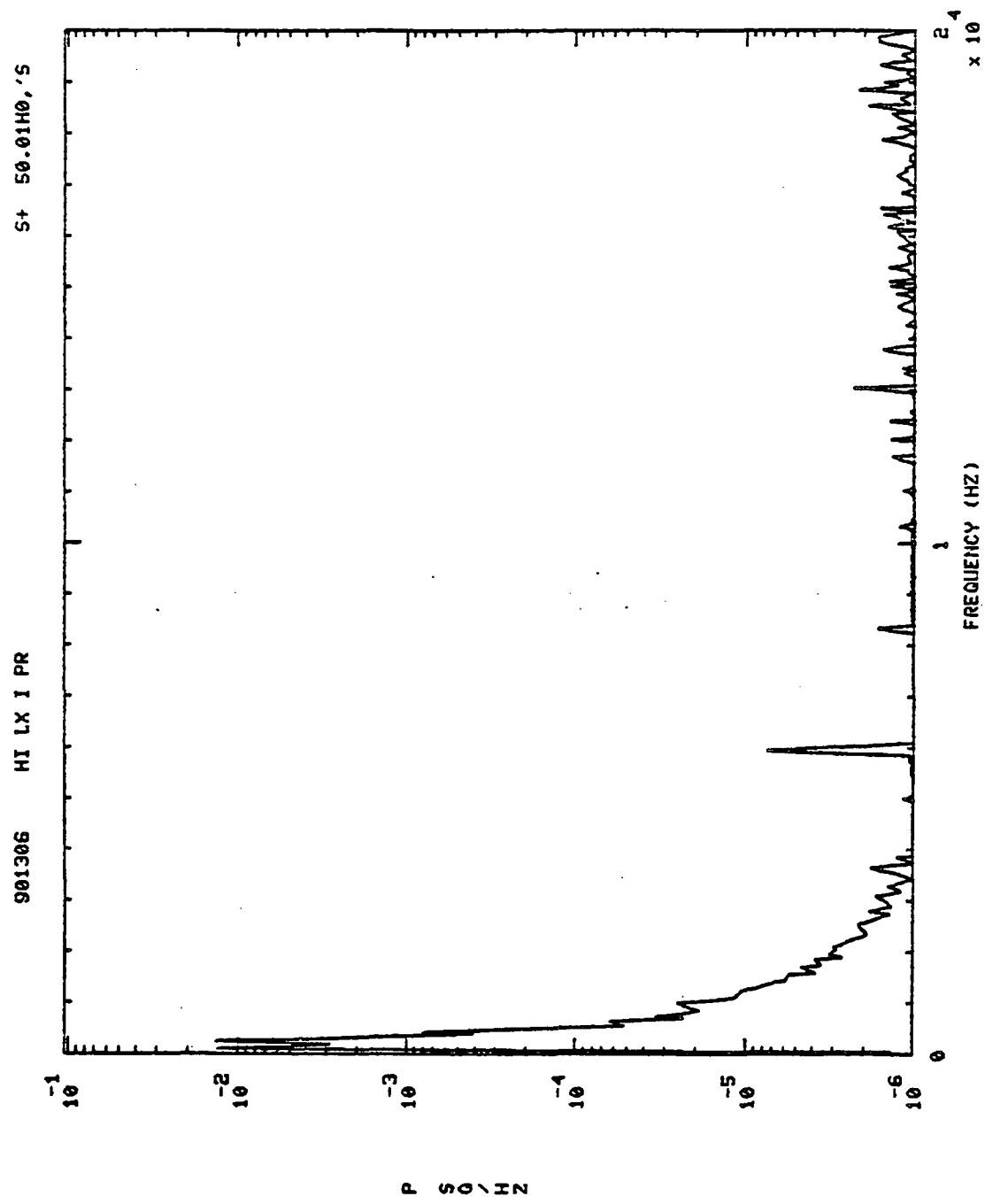


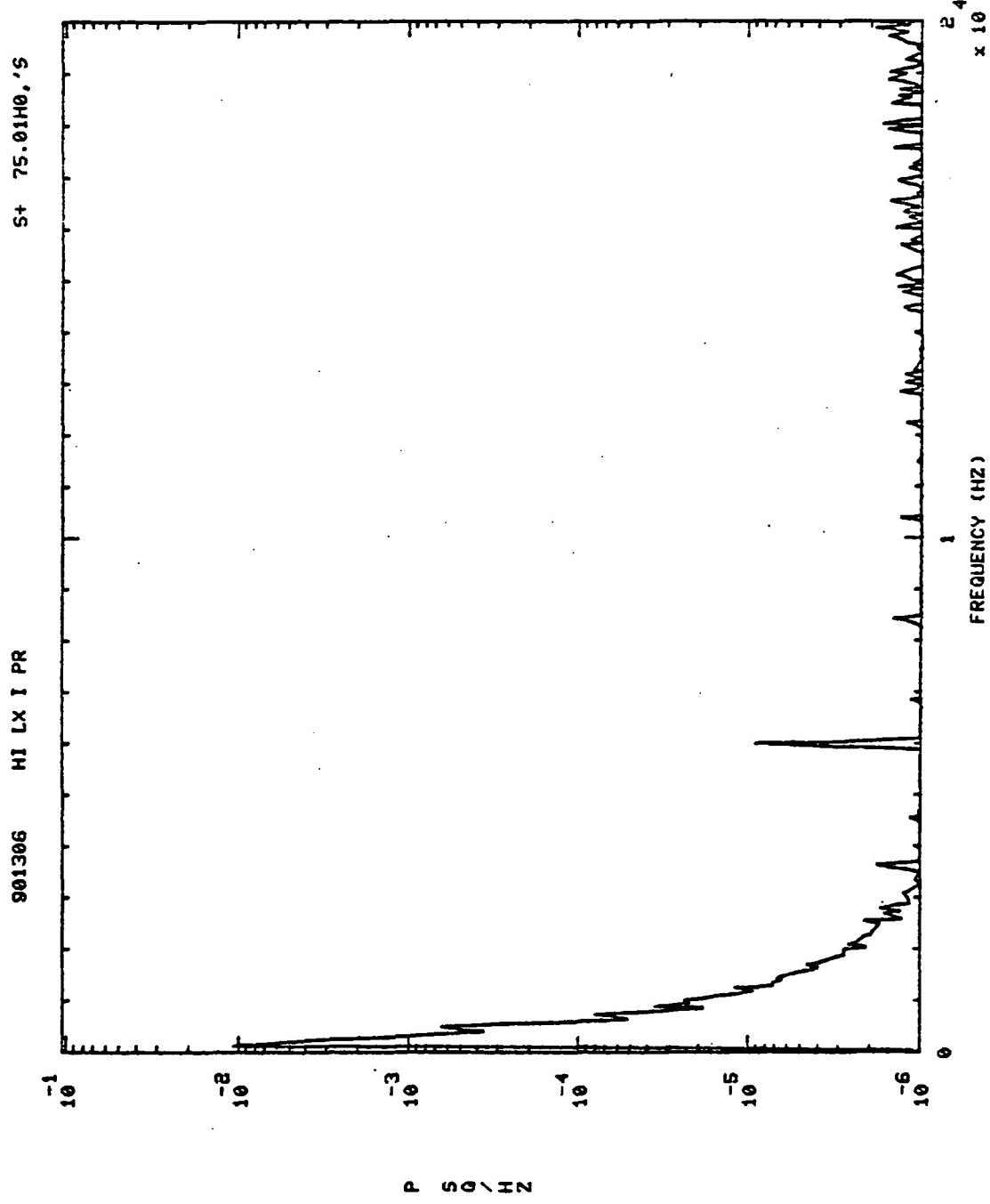
$S + 5.01H_0, 'S$

901306 HI LX I PR

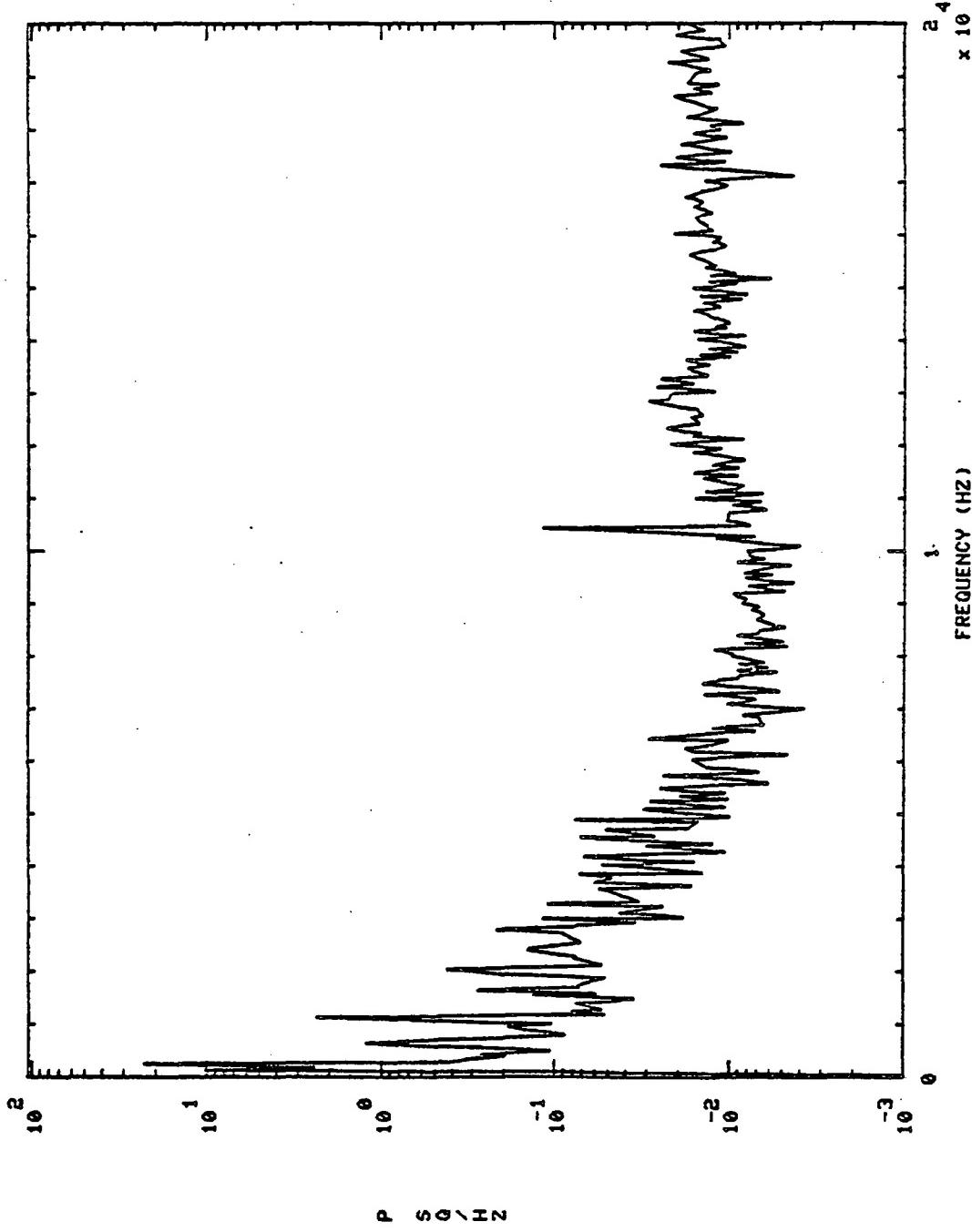


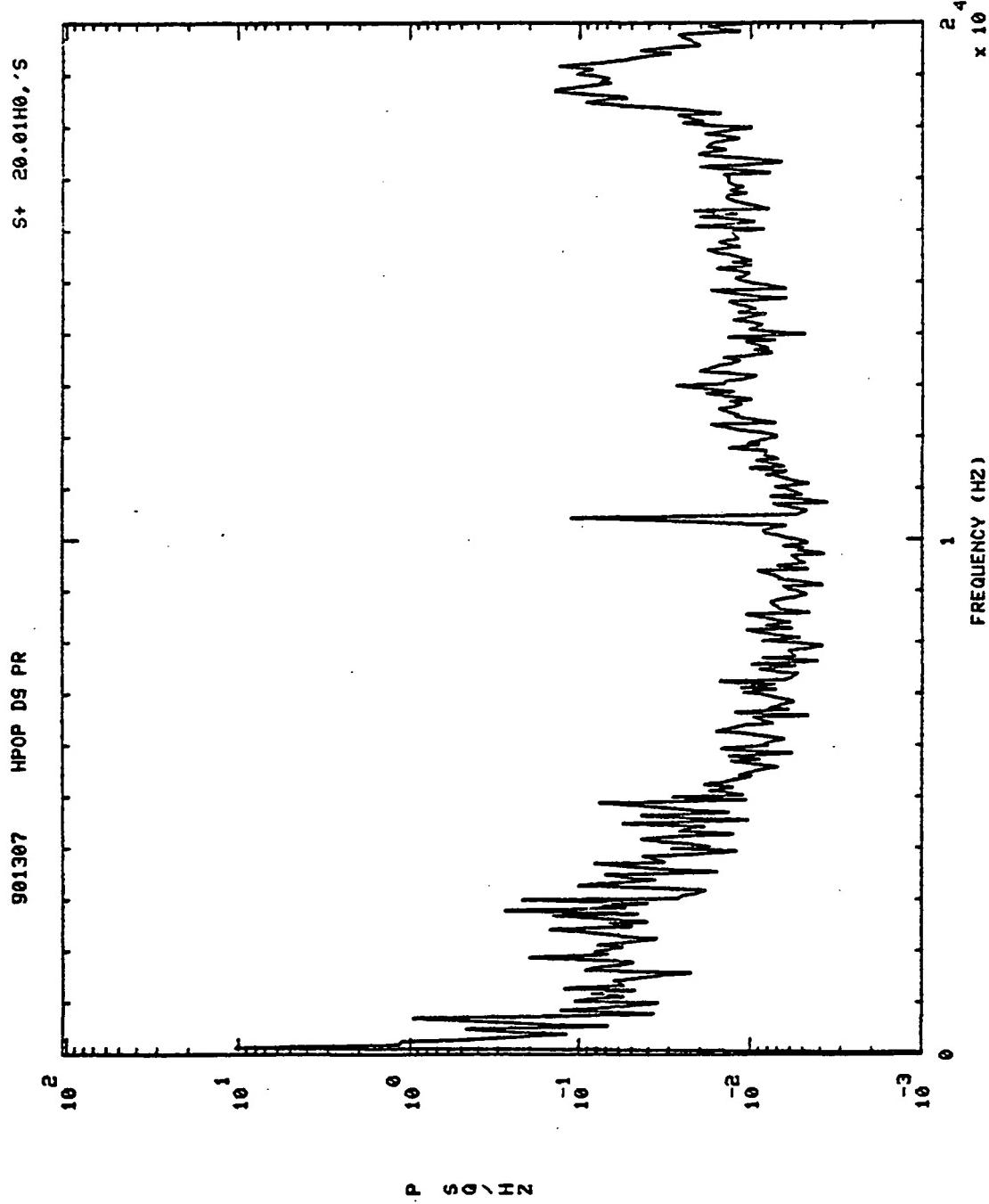






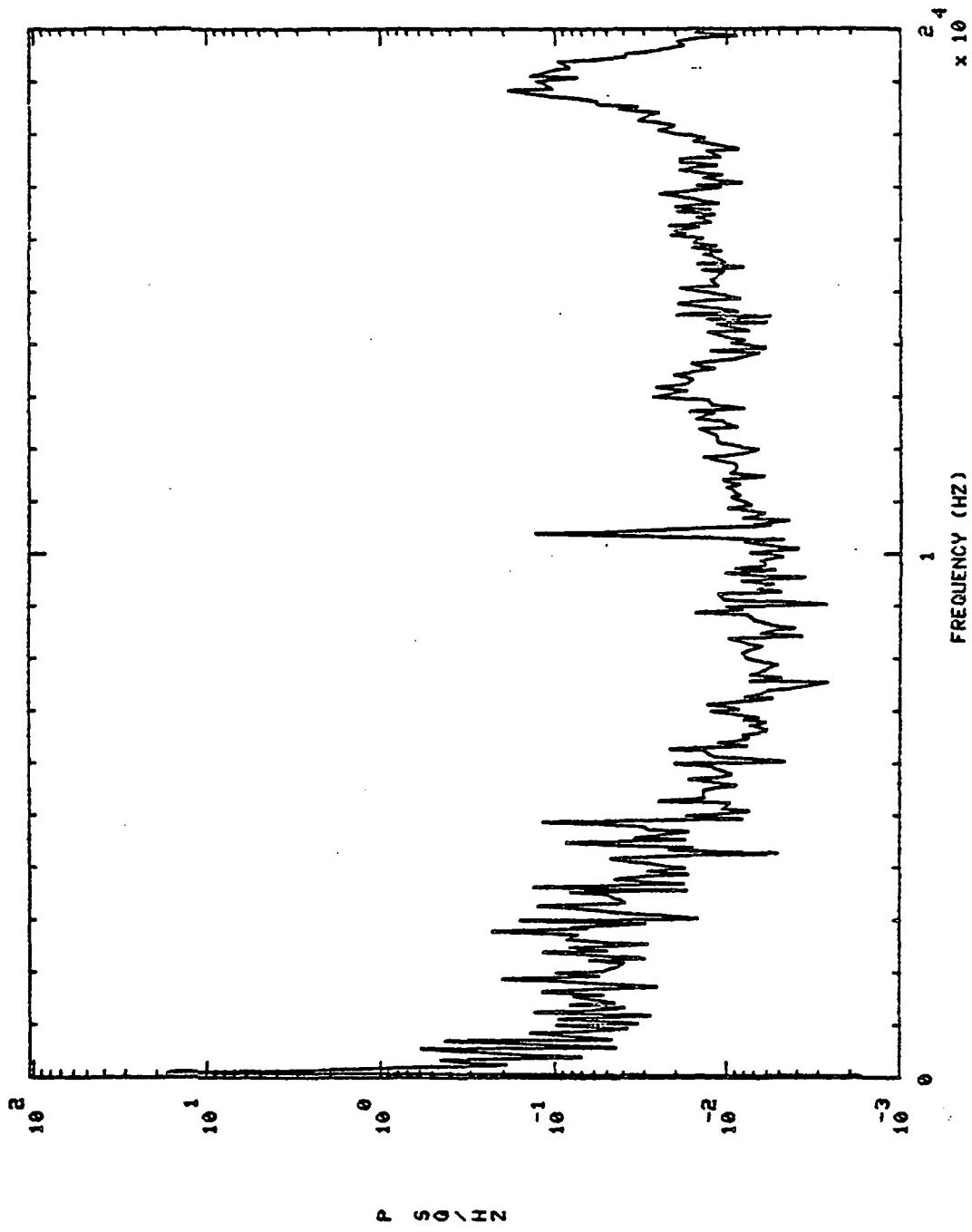
9001307 HPOP DS PR S+ 5.01Hz, S

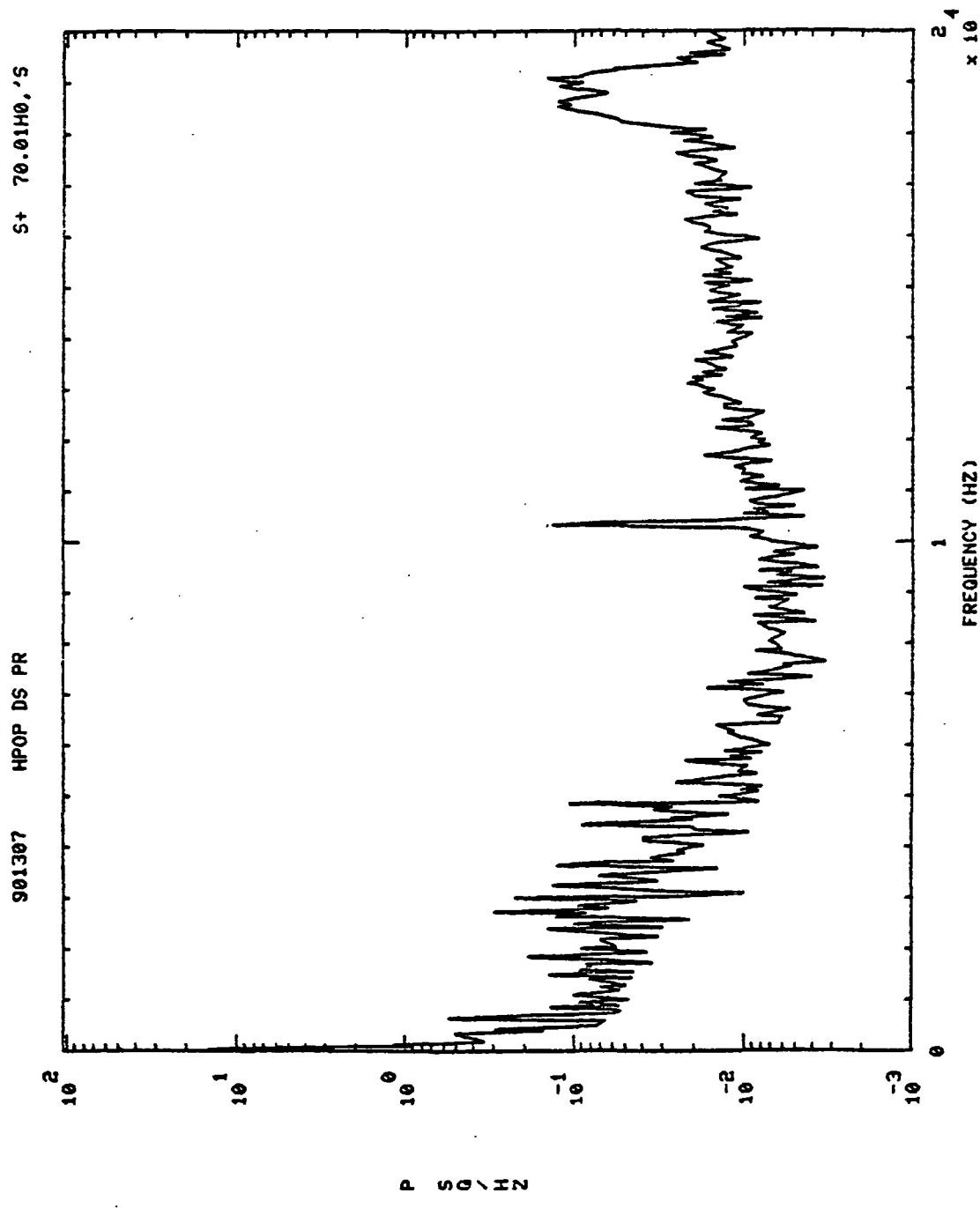




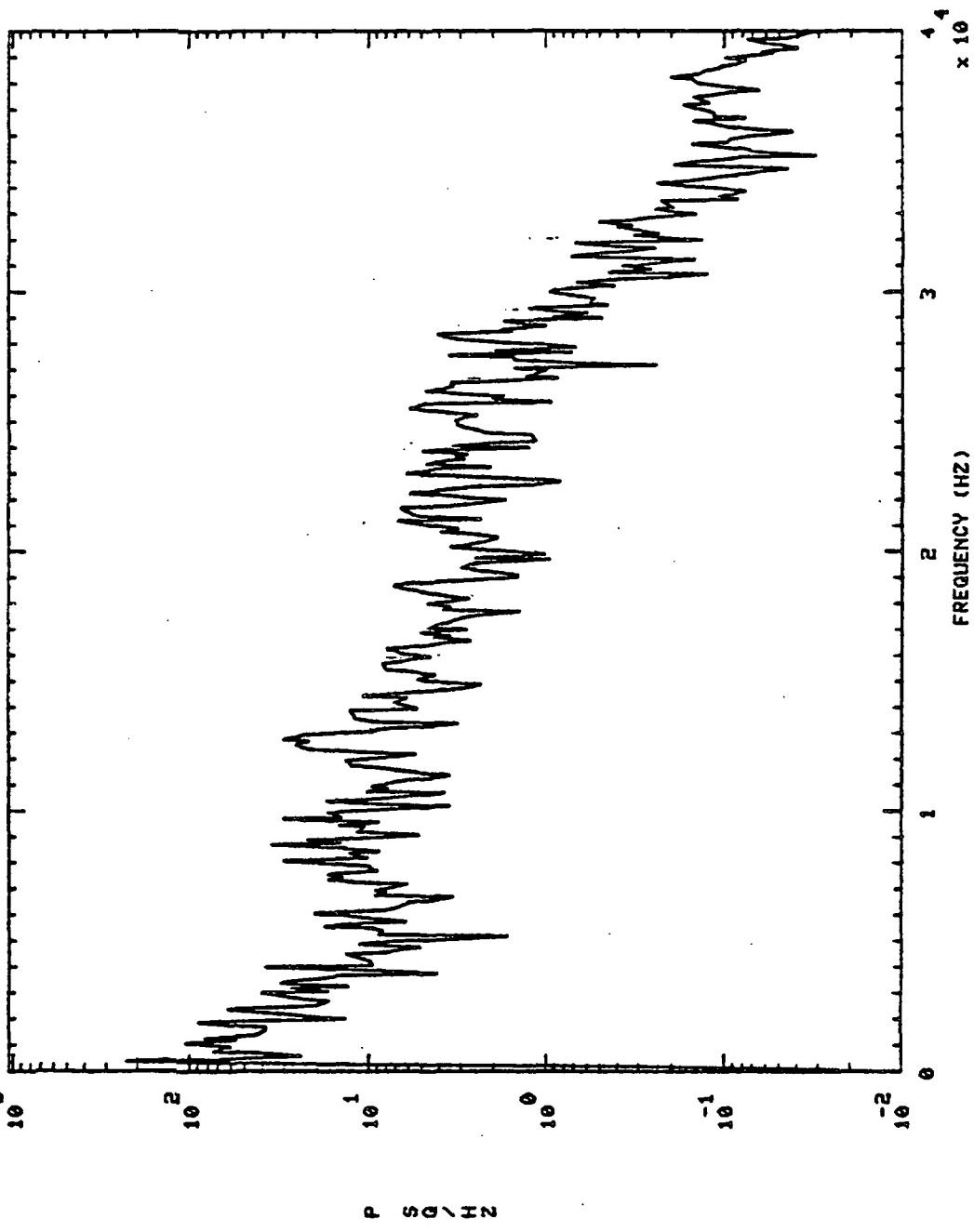
S+ 45.01H0,'S

901307 HPOP DS PR



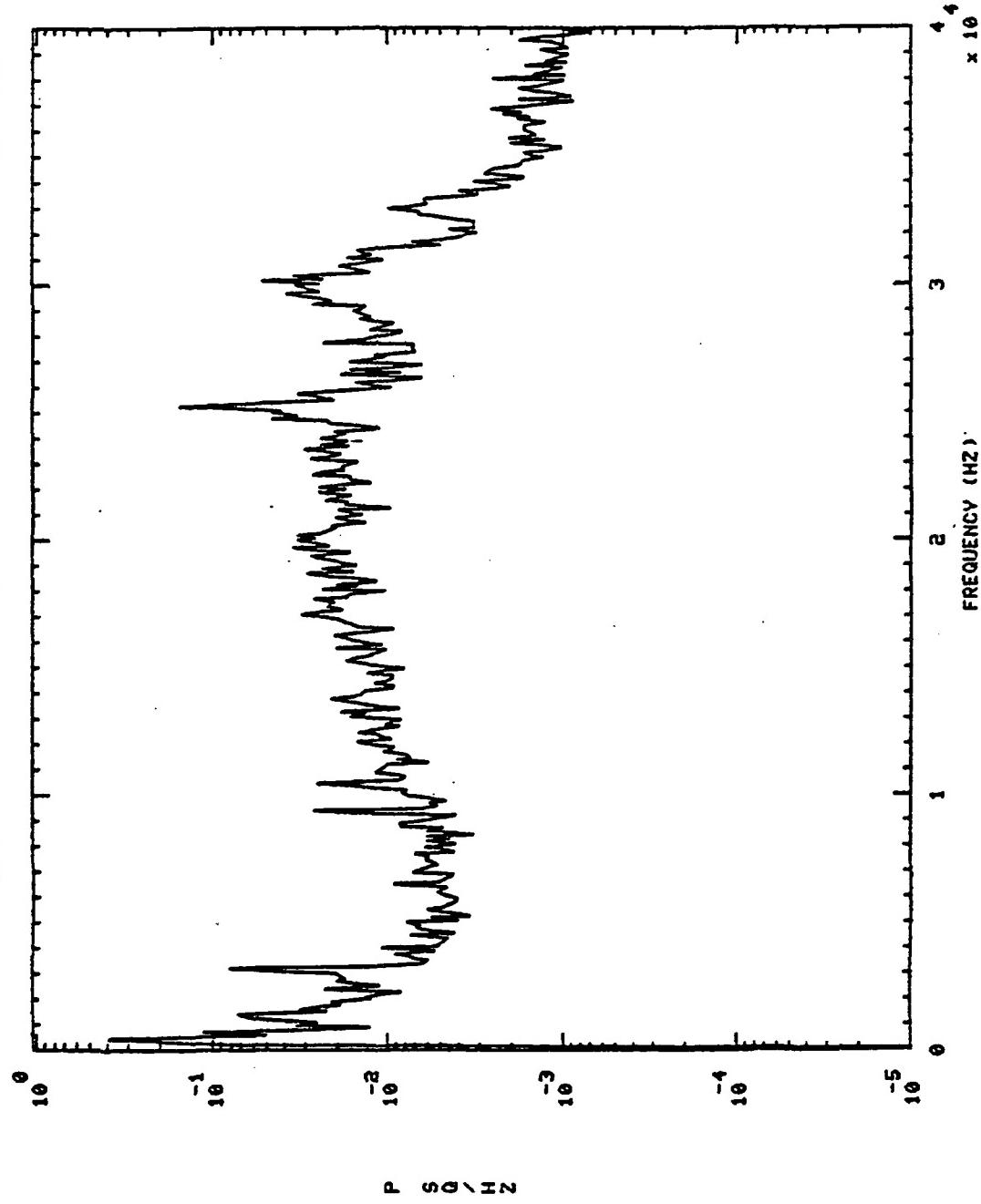


5+ E.01H0, 5
801307 MC3 HOT GR3 IN PR



901307 MCC HOT GAS IN PR

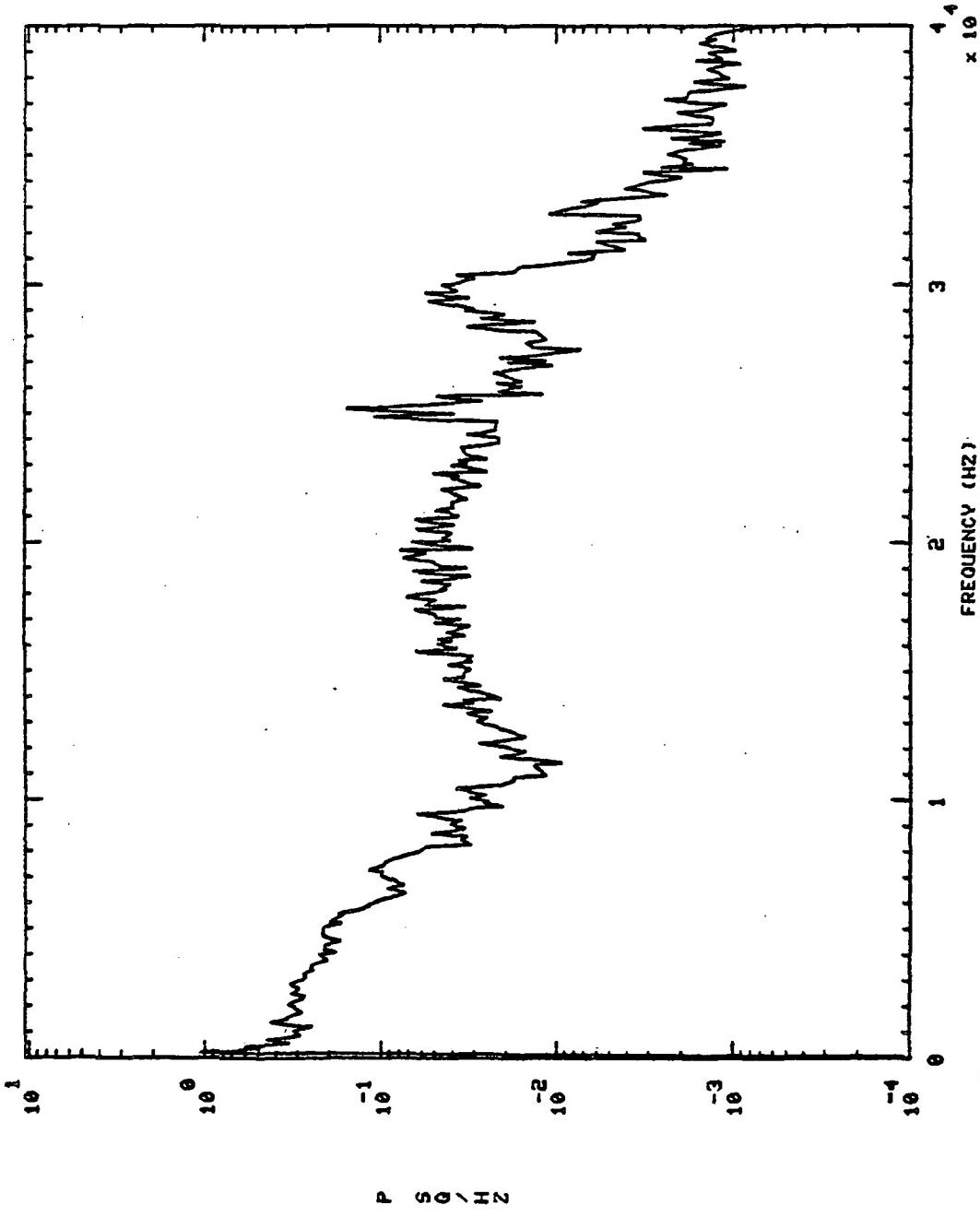
S+ 20.01HQ. /S

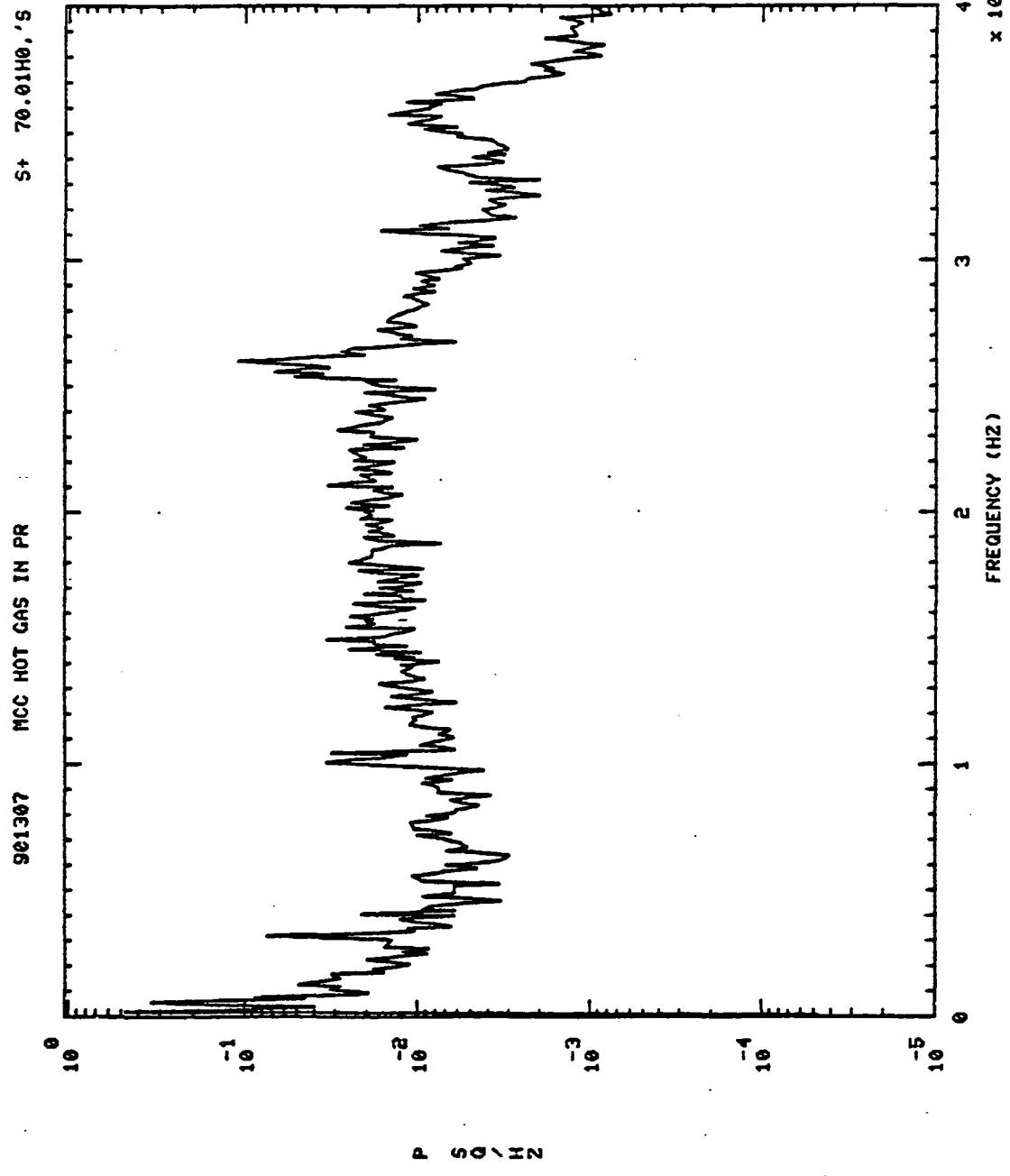


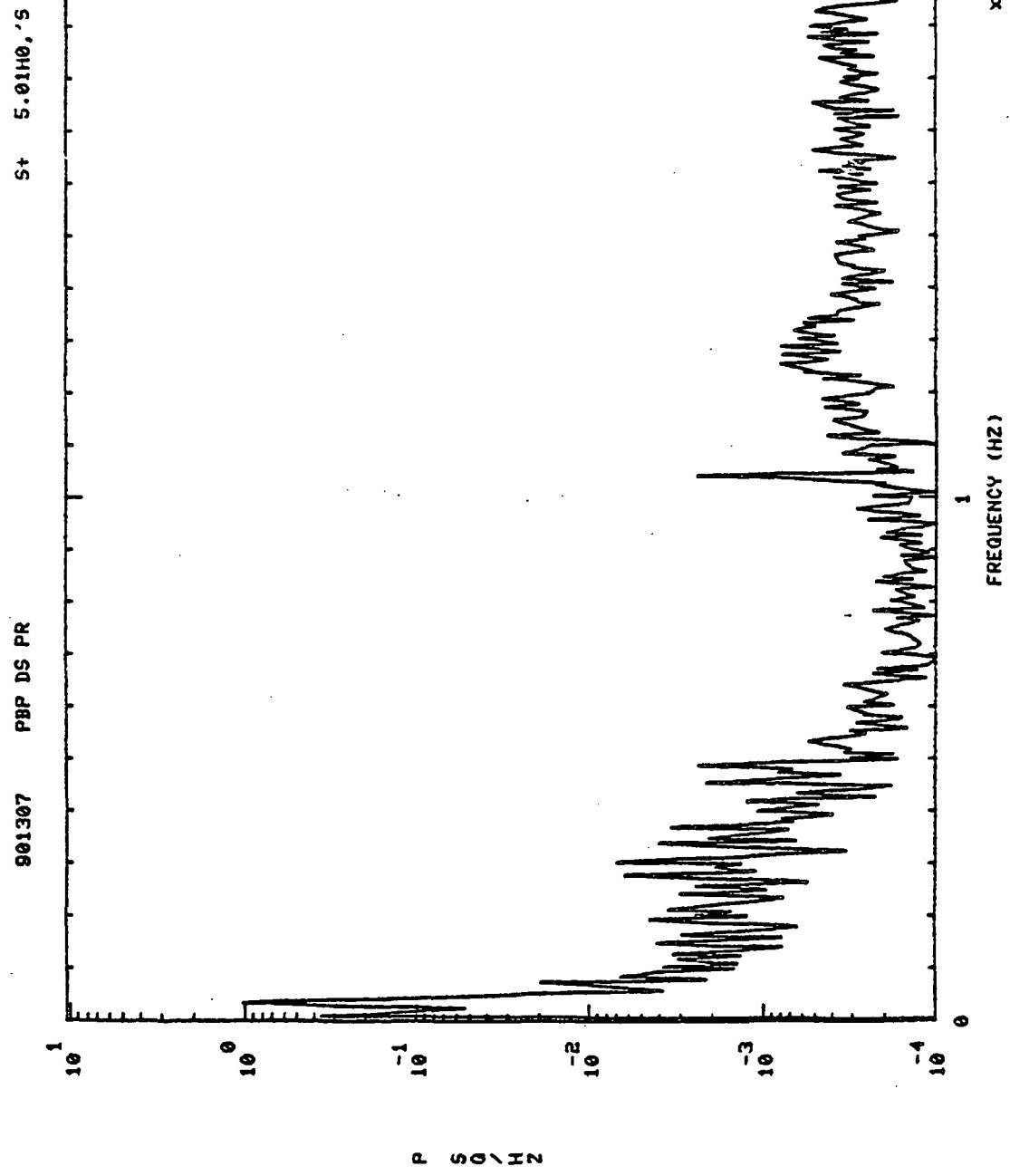
S+ 45.01H0, 'S

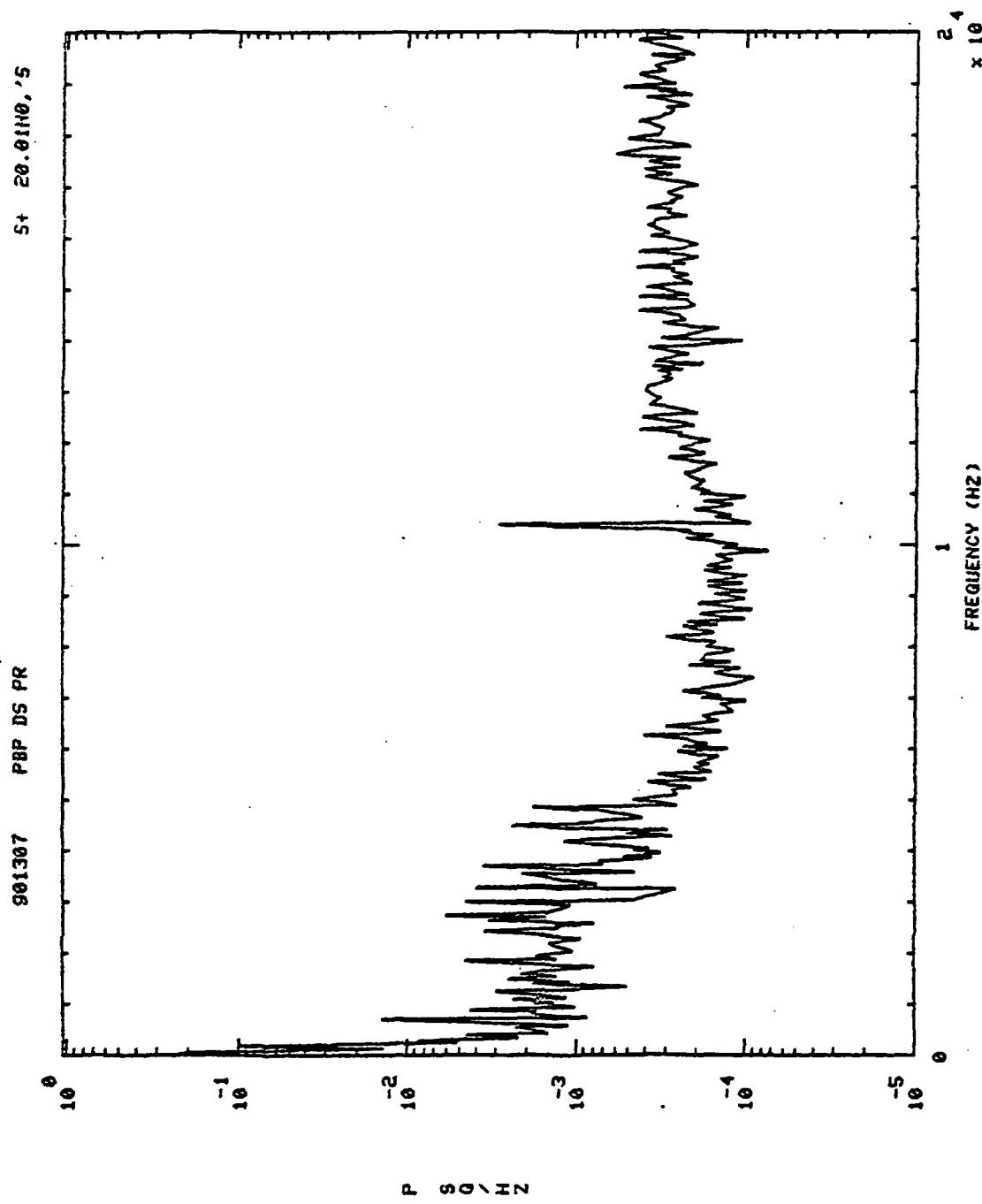
MCC HOT GAS IN PR

SE01307



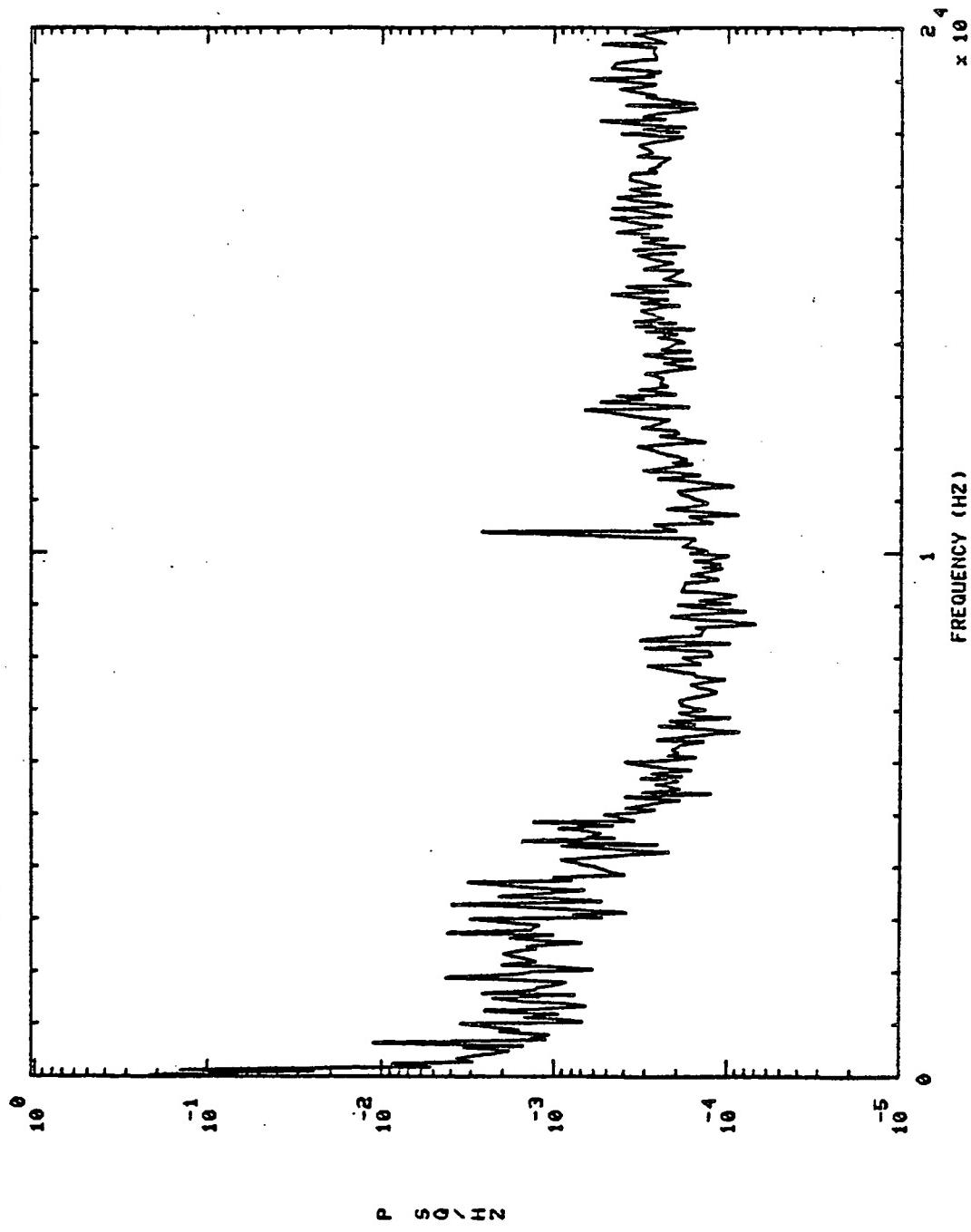




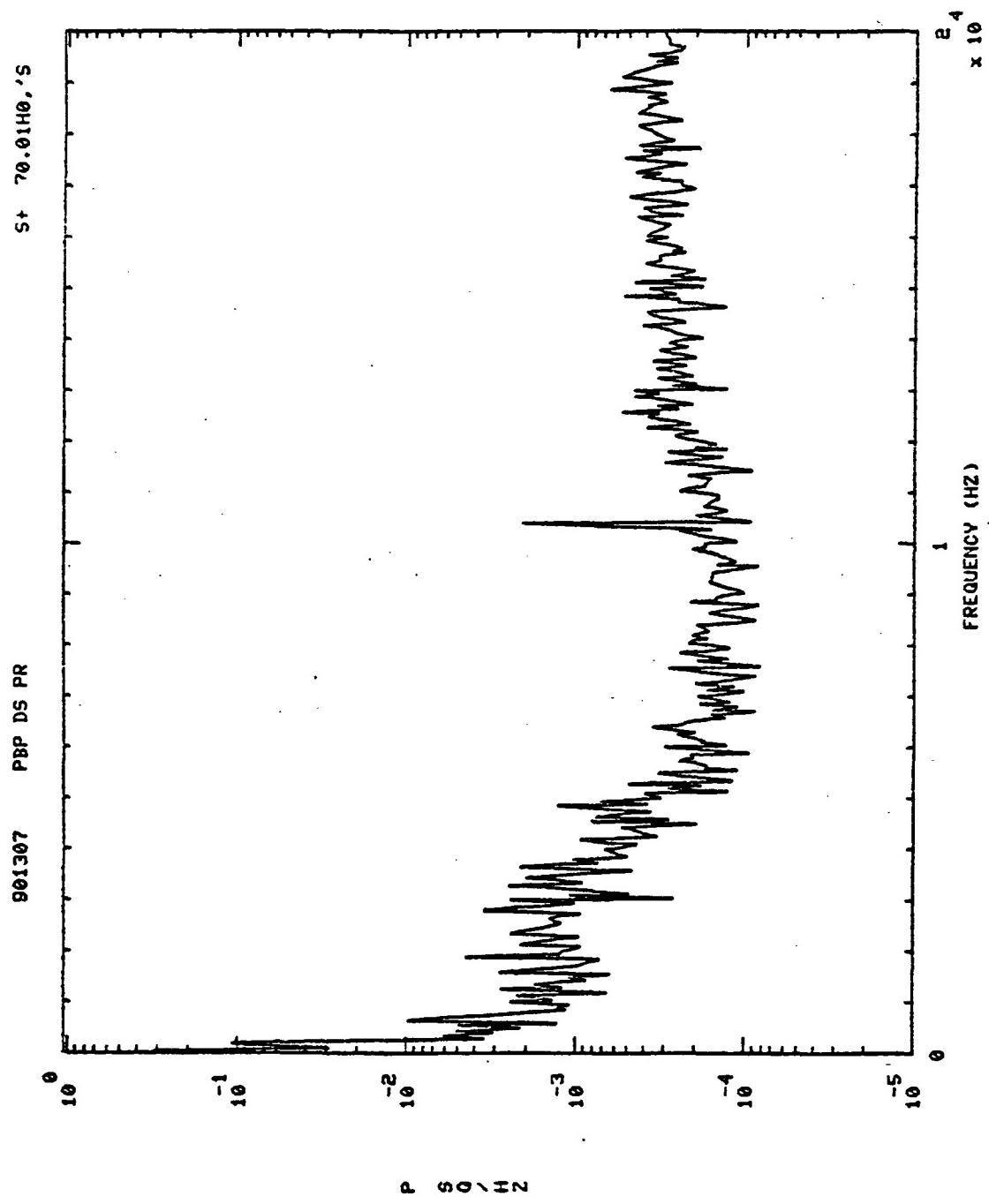


S+ 45.01H0.'S

901307 PBP DS PR

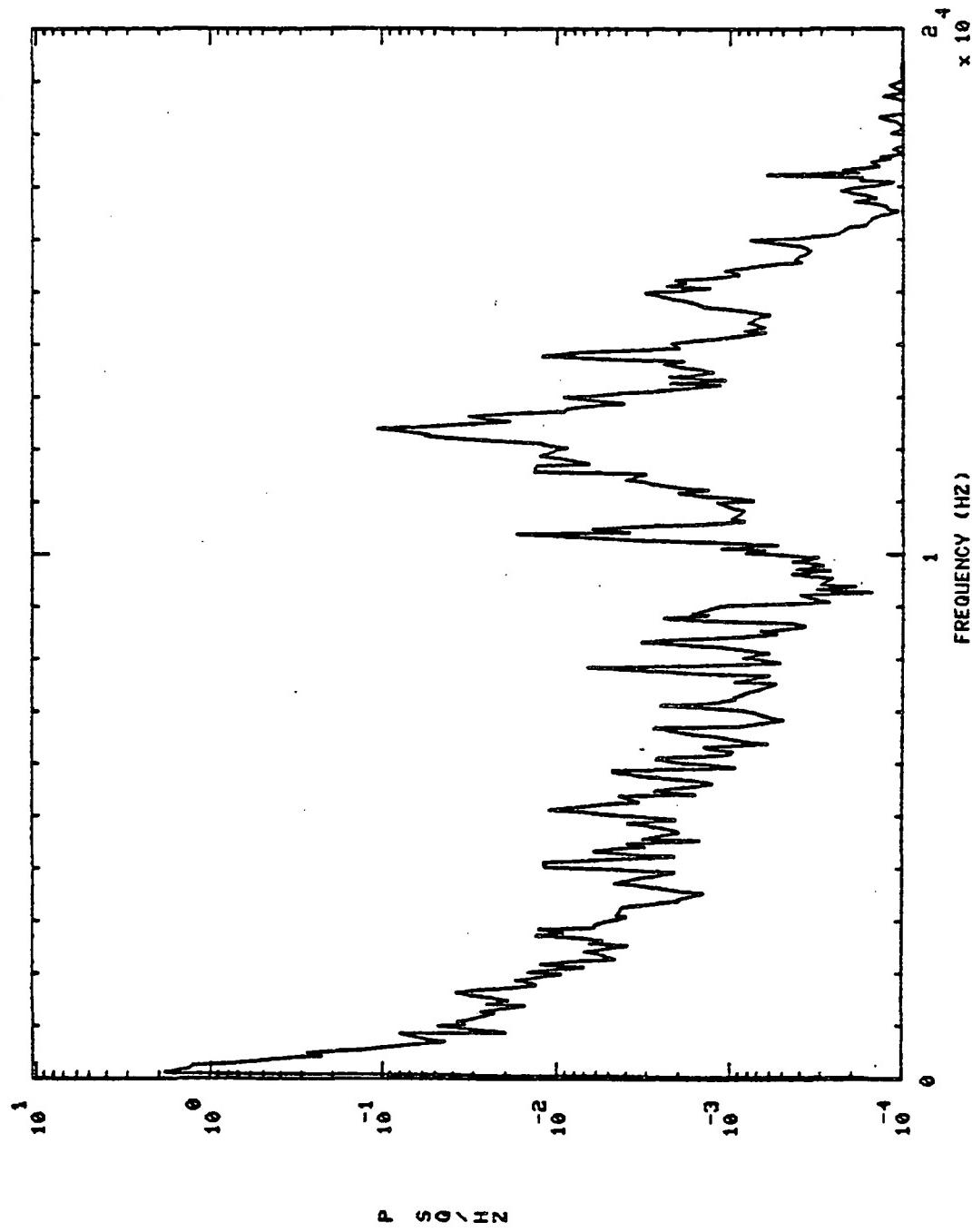


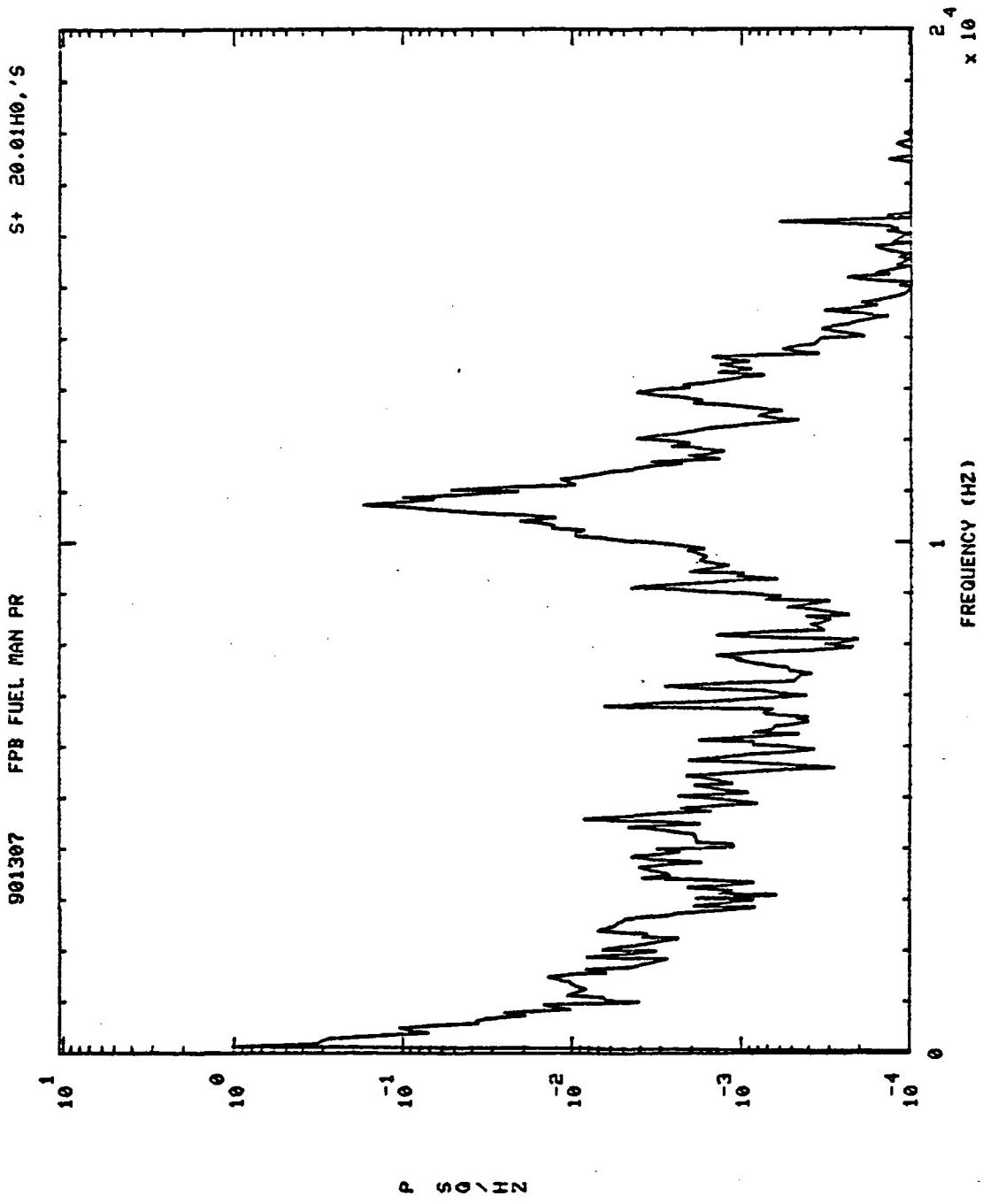
P S Q / HZ



S+ 5.01H0, 6

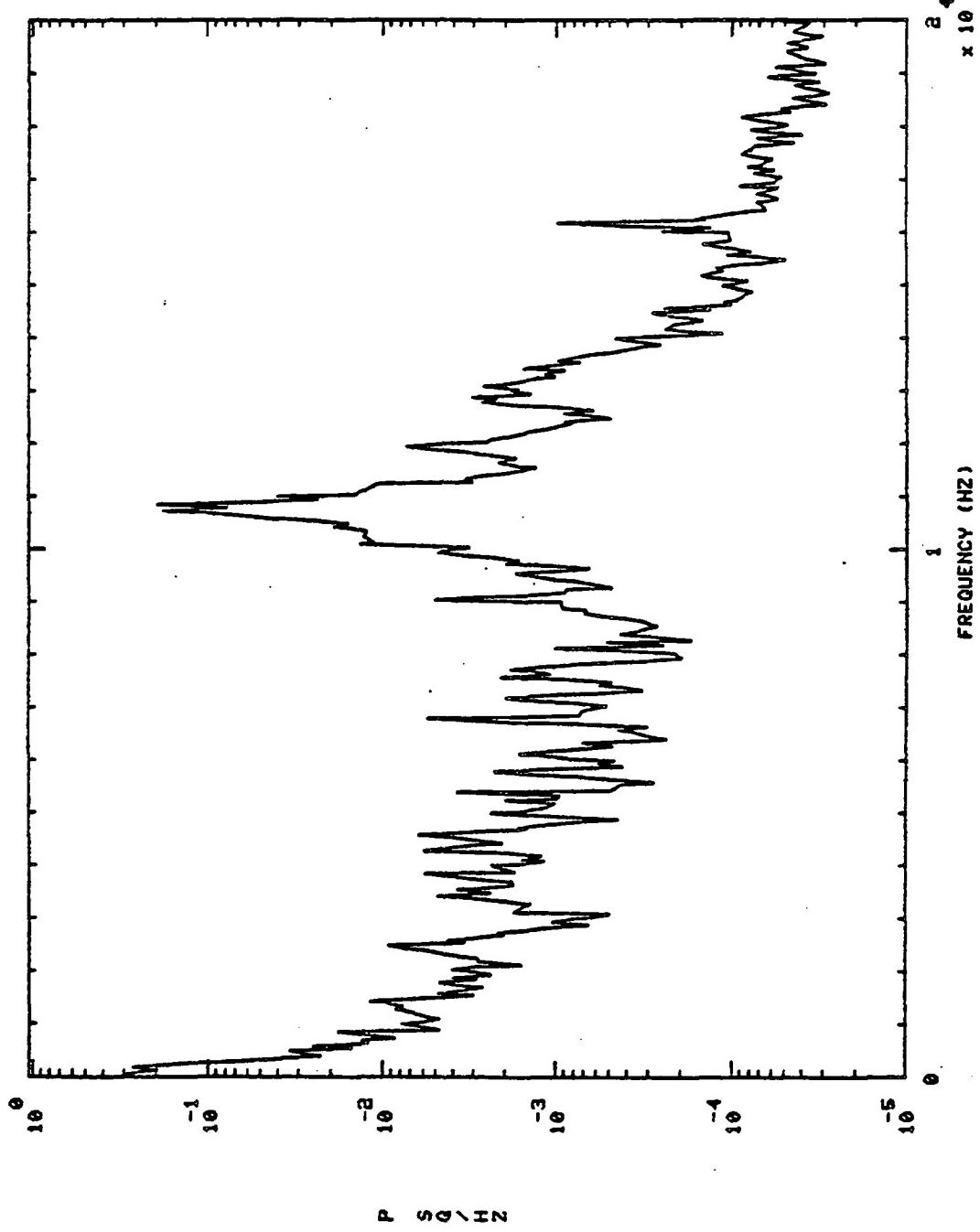
901307 FPB FUEL MAN PR



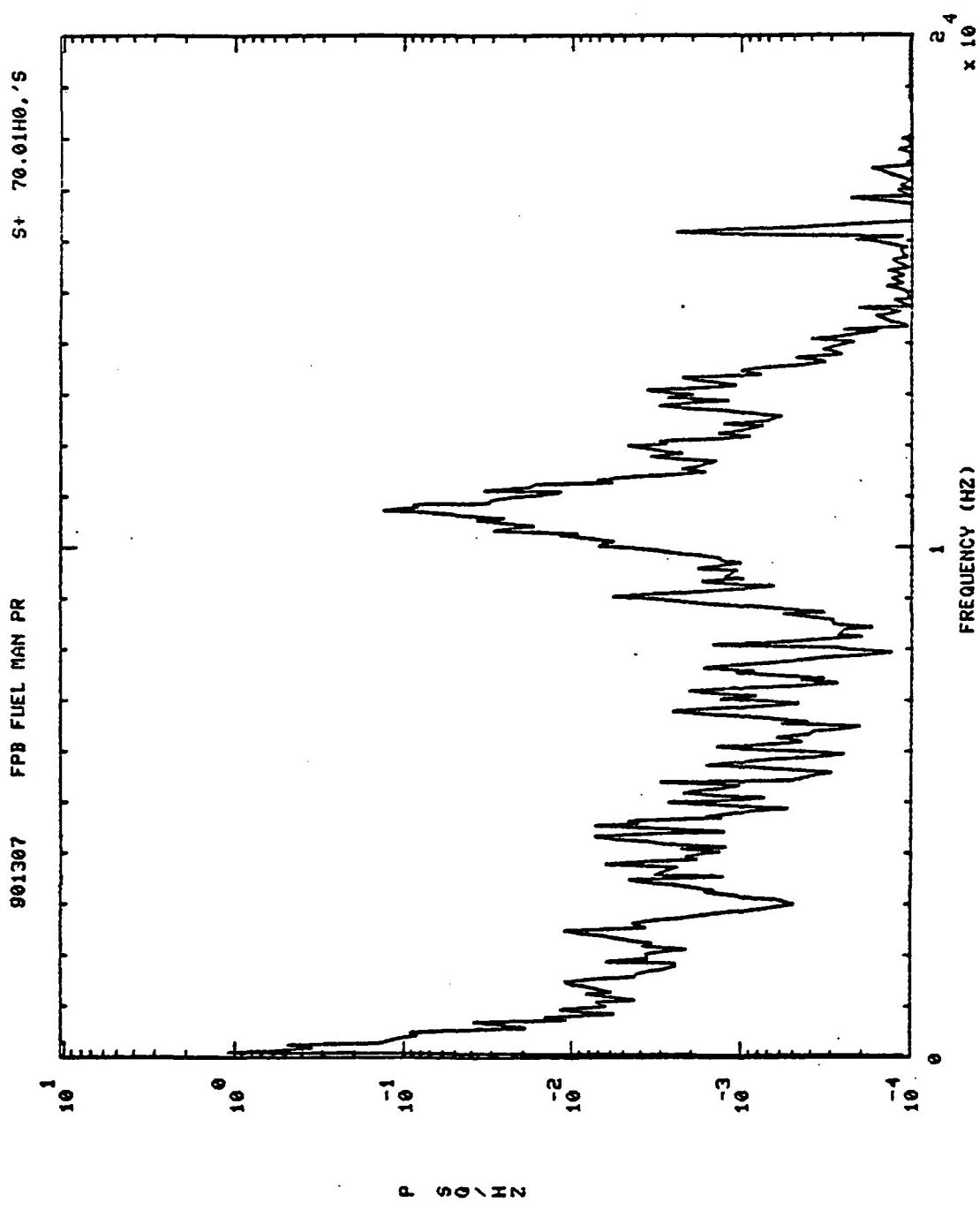


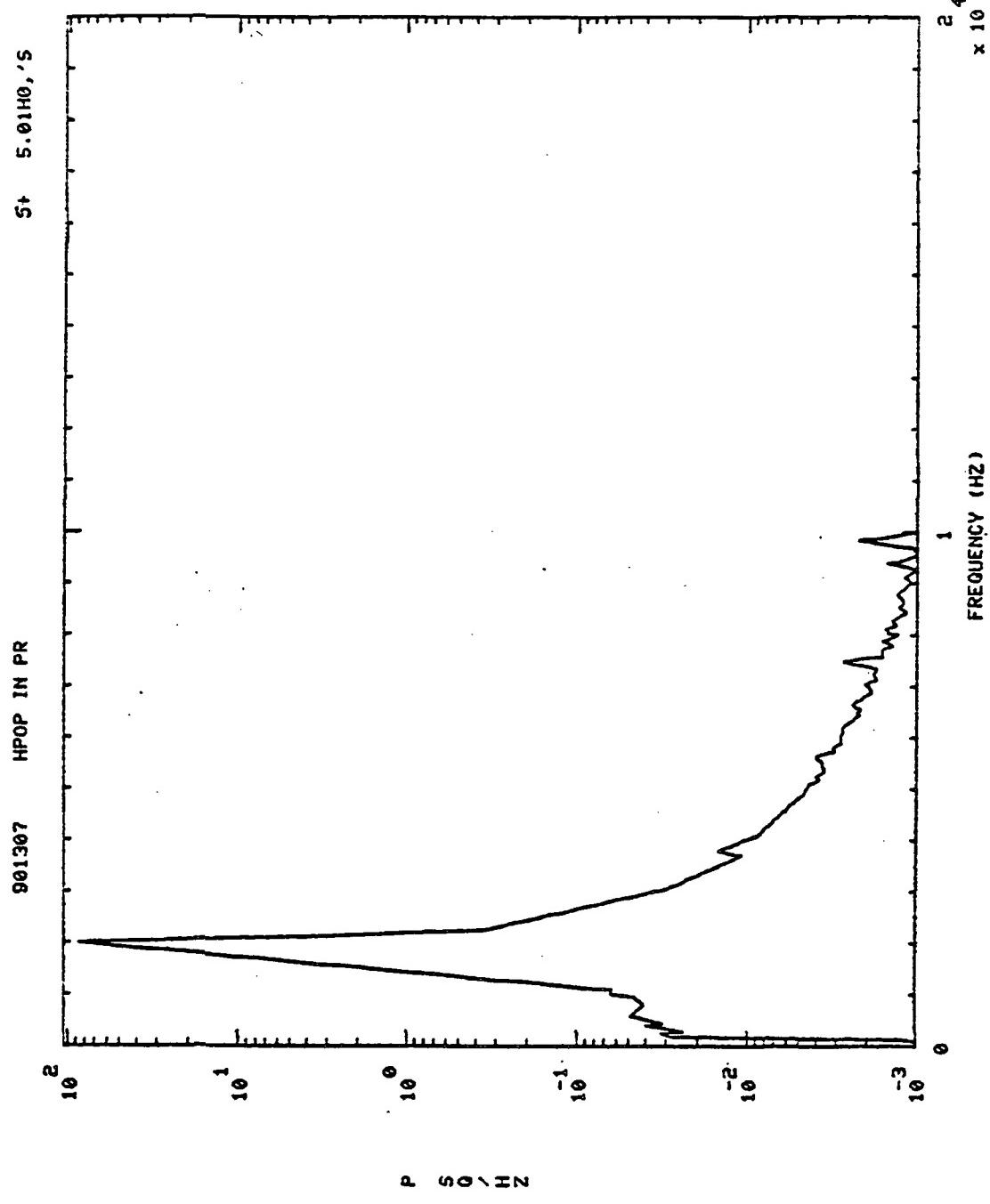
S+ 45.01H0.'S

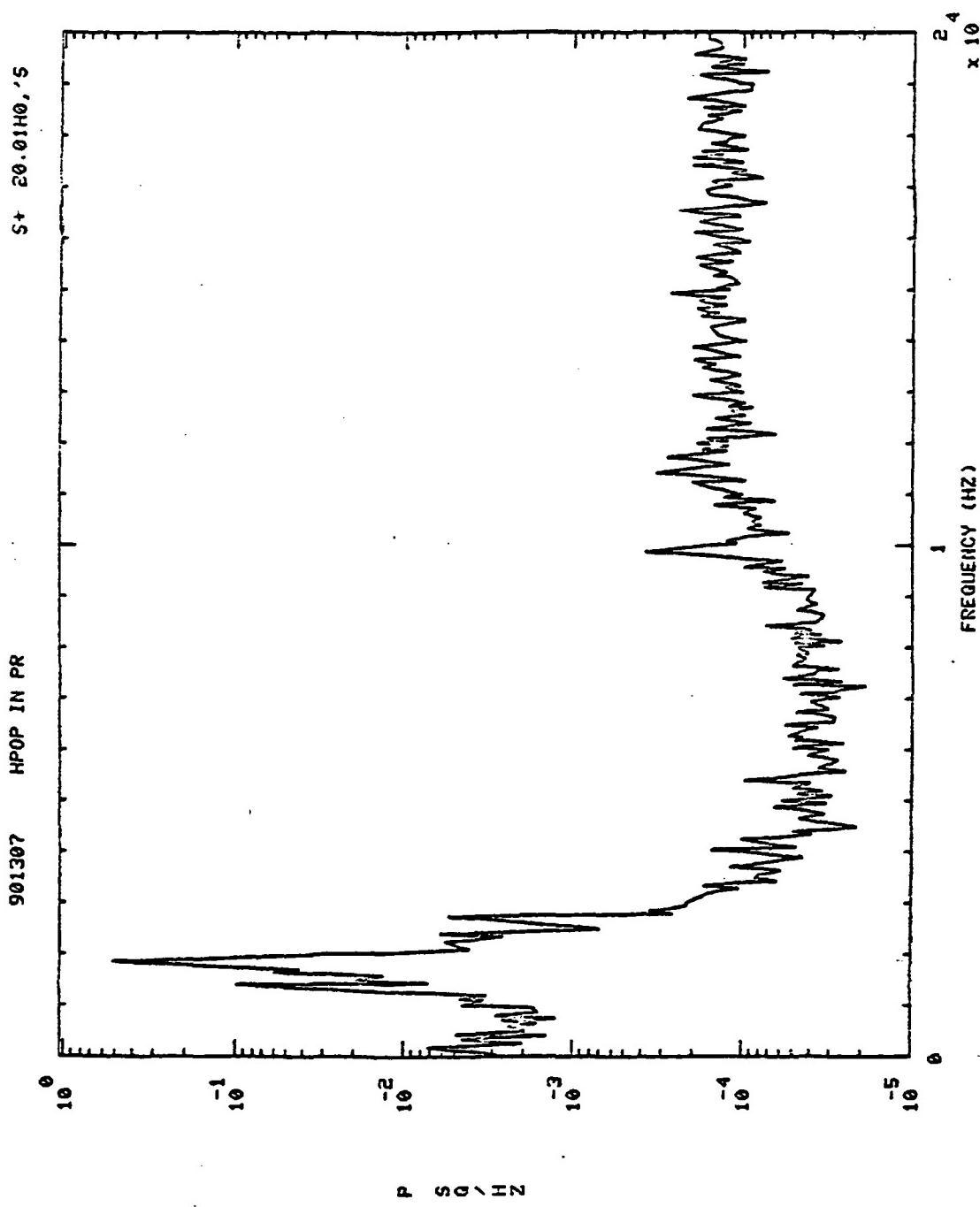
FPB FUEL MAN PR
901307



P S/Hz

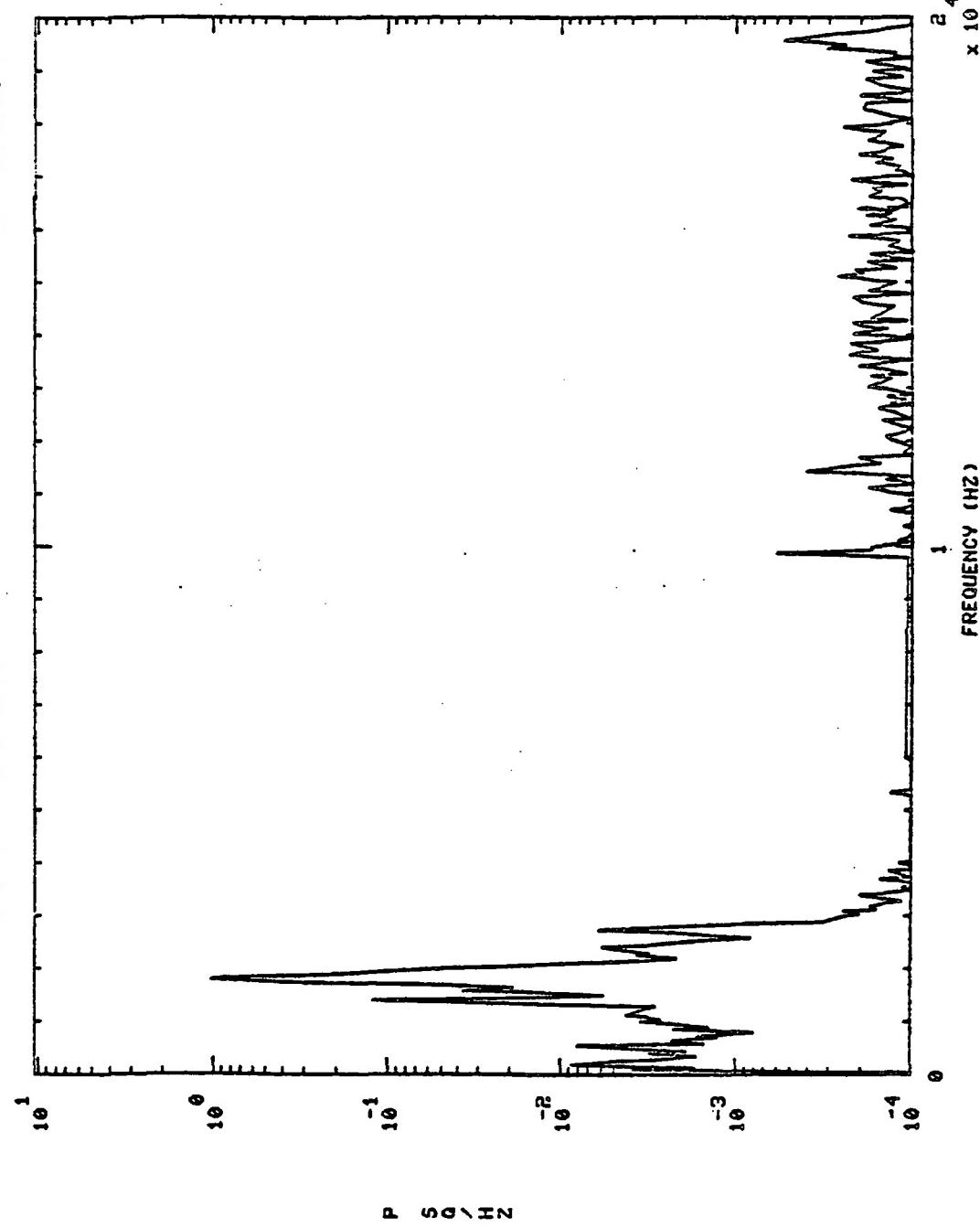


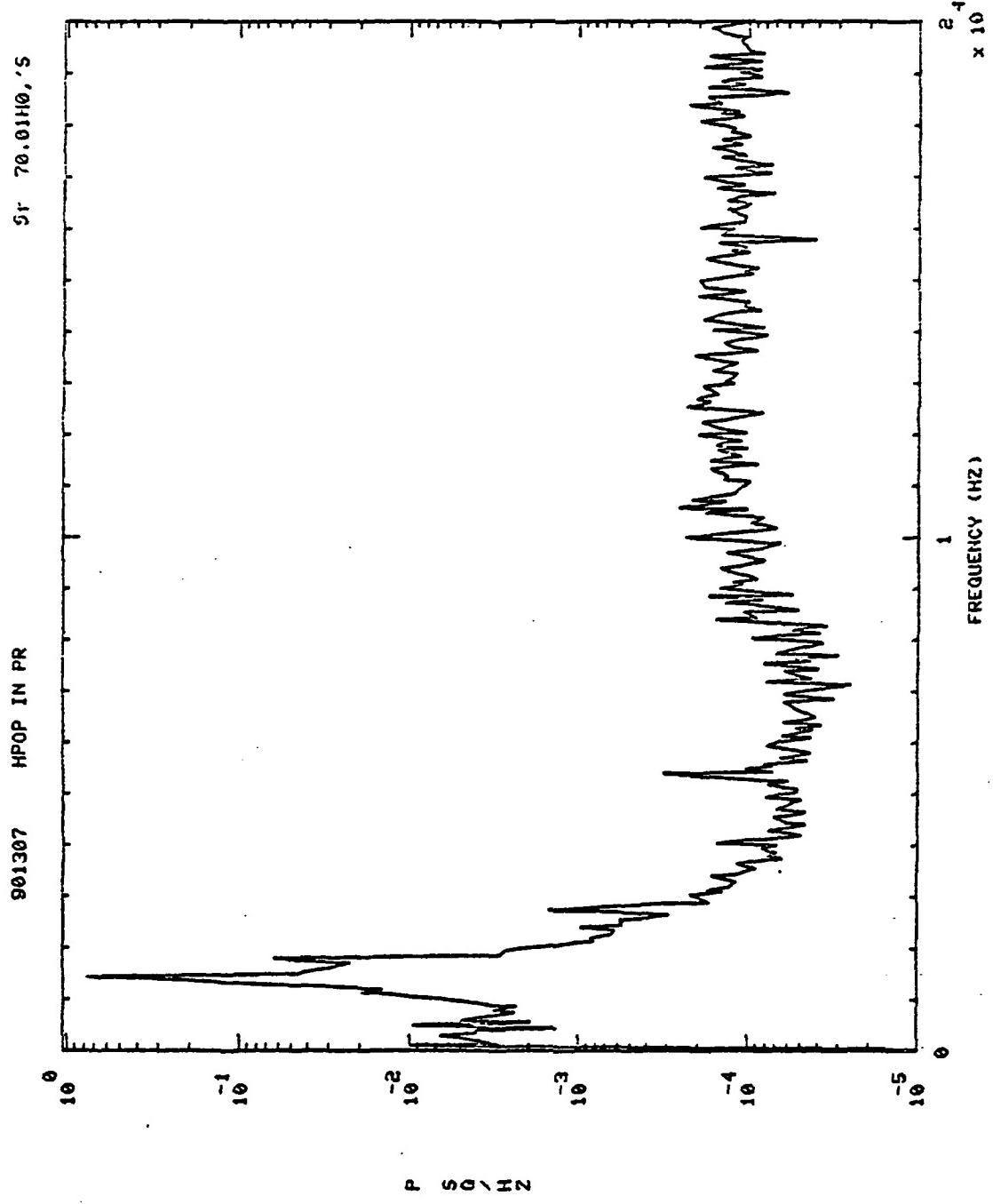




901307

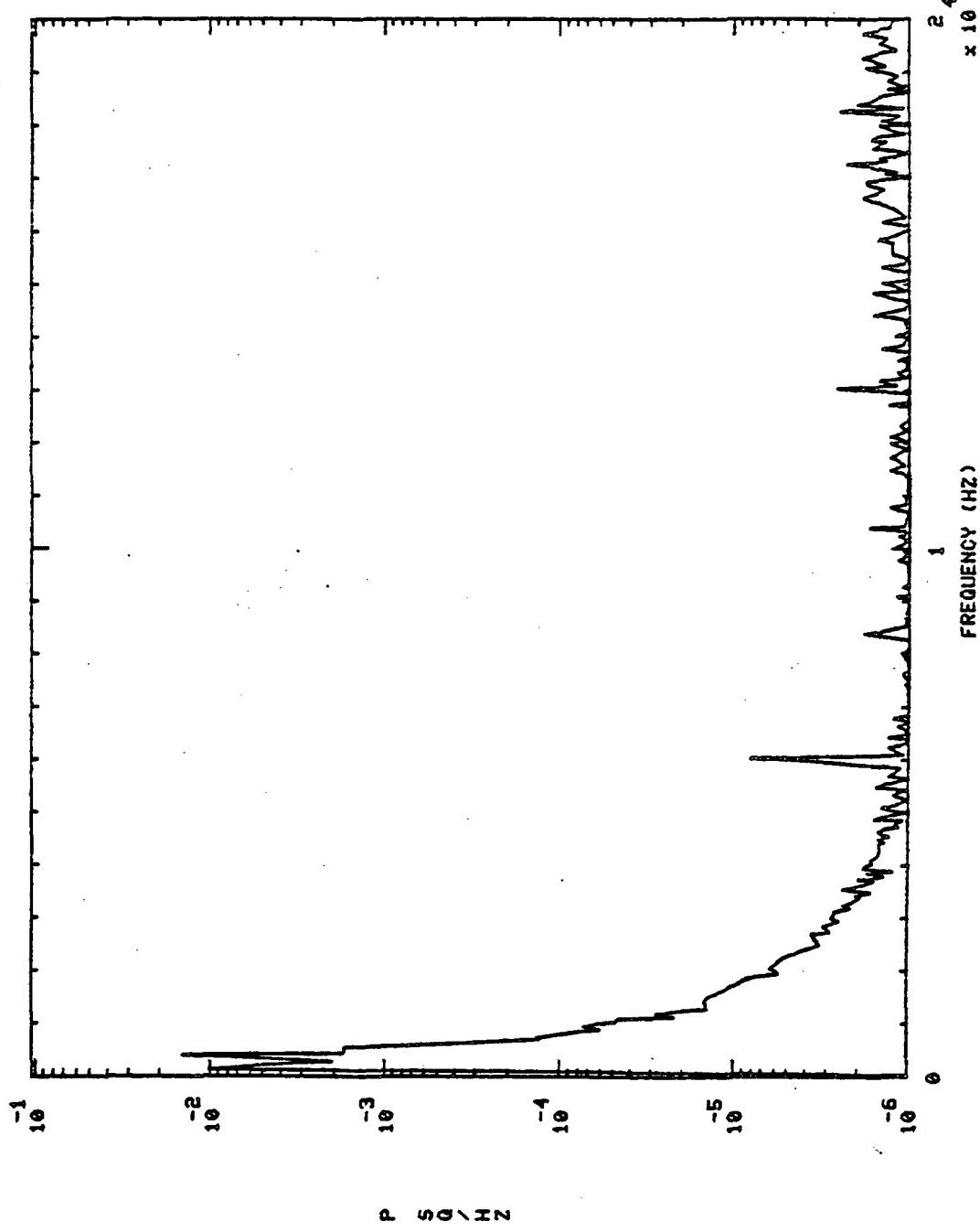
St 45.01110, 'S

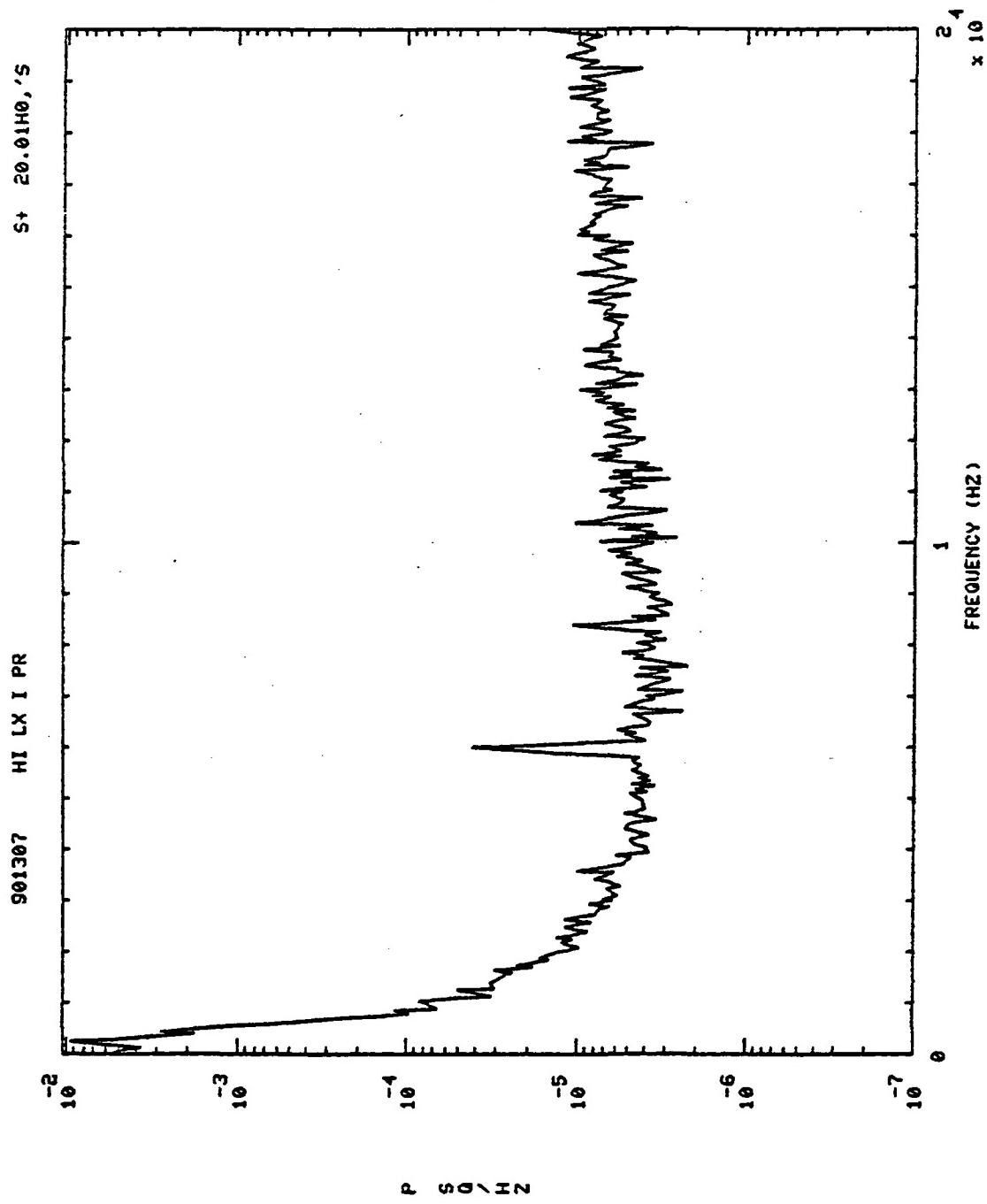




S+ 5.01H0./S

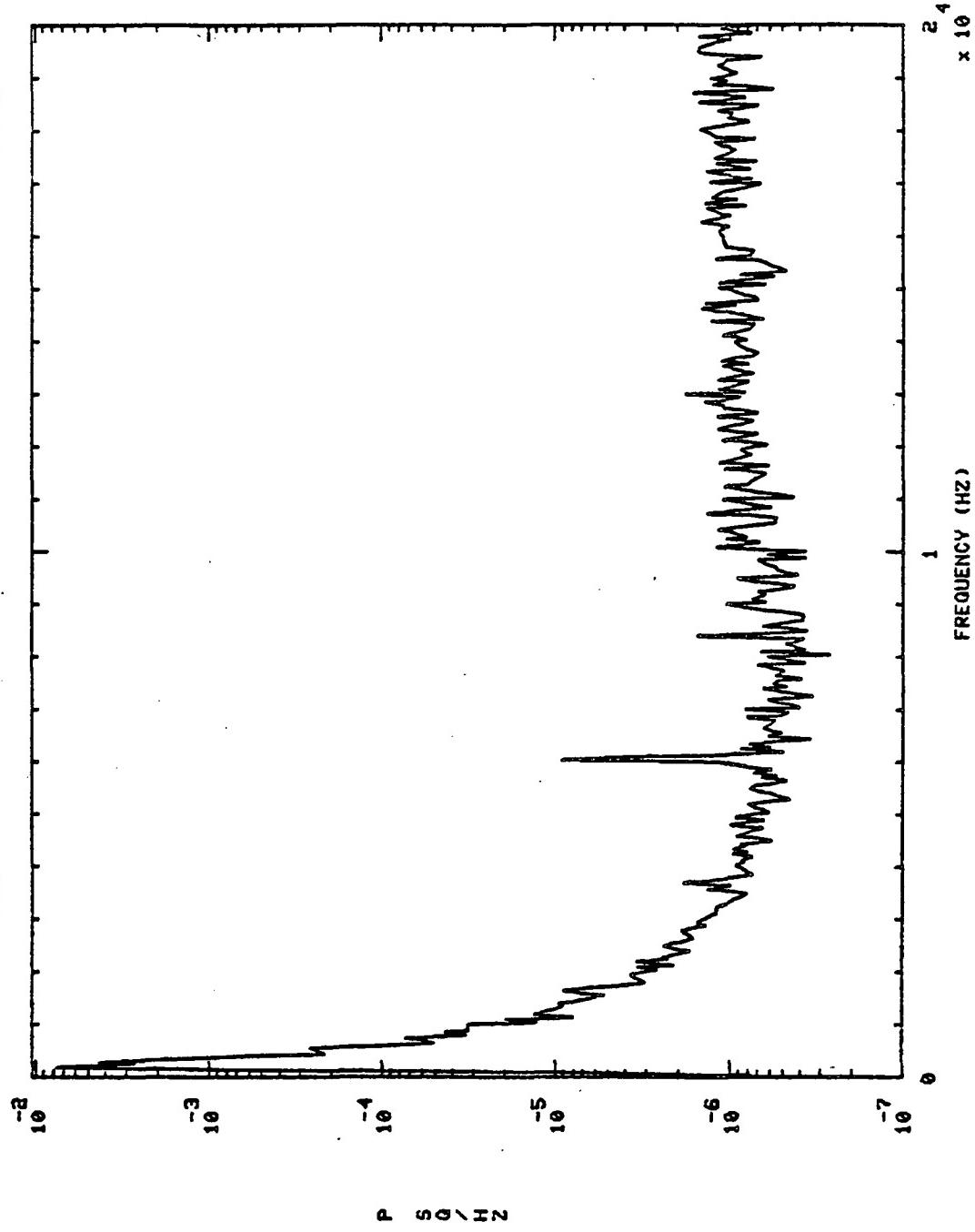
901307 HI LX I PR

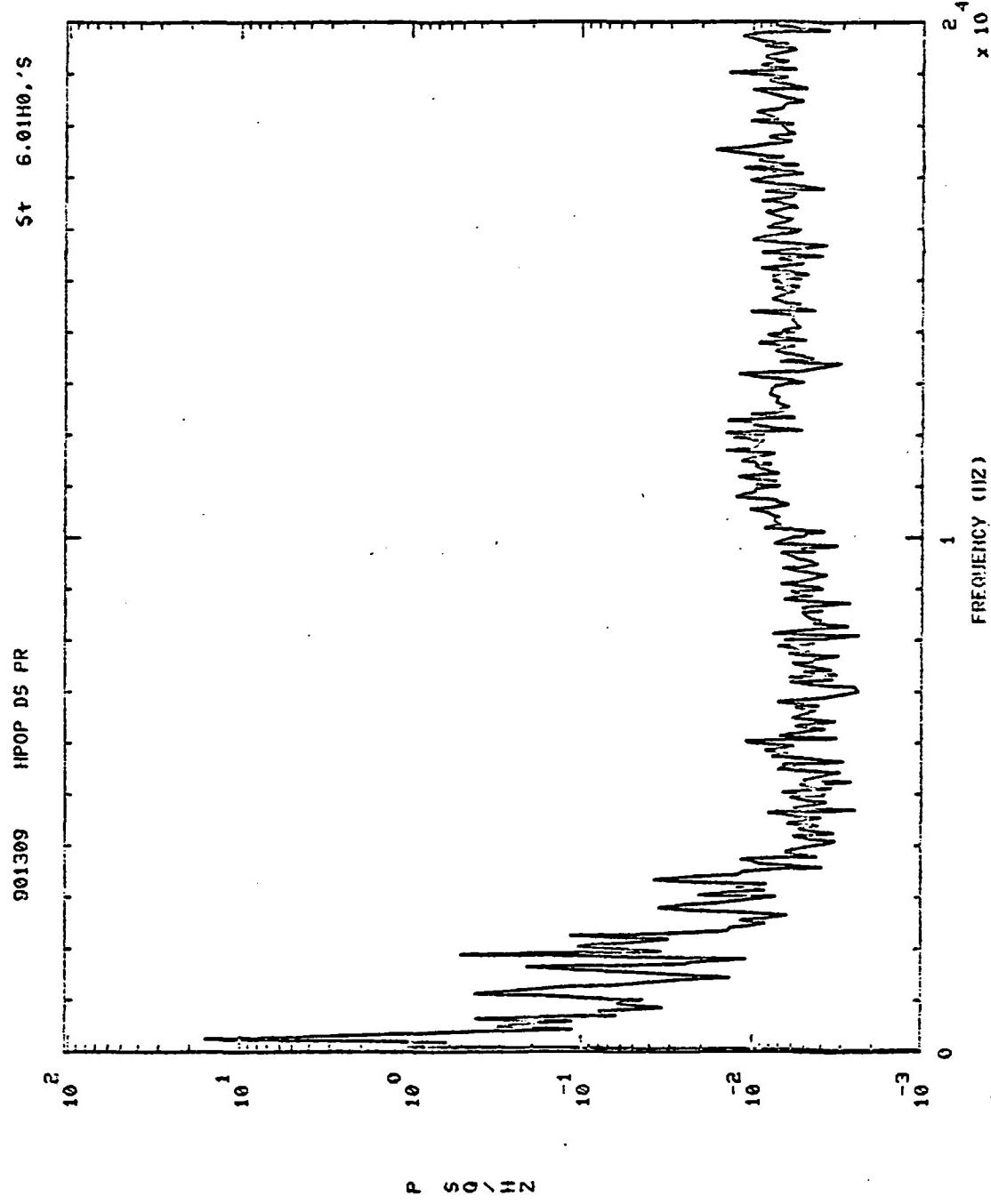




901307 HI LX I PR

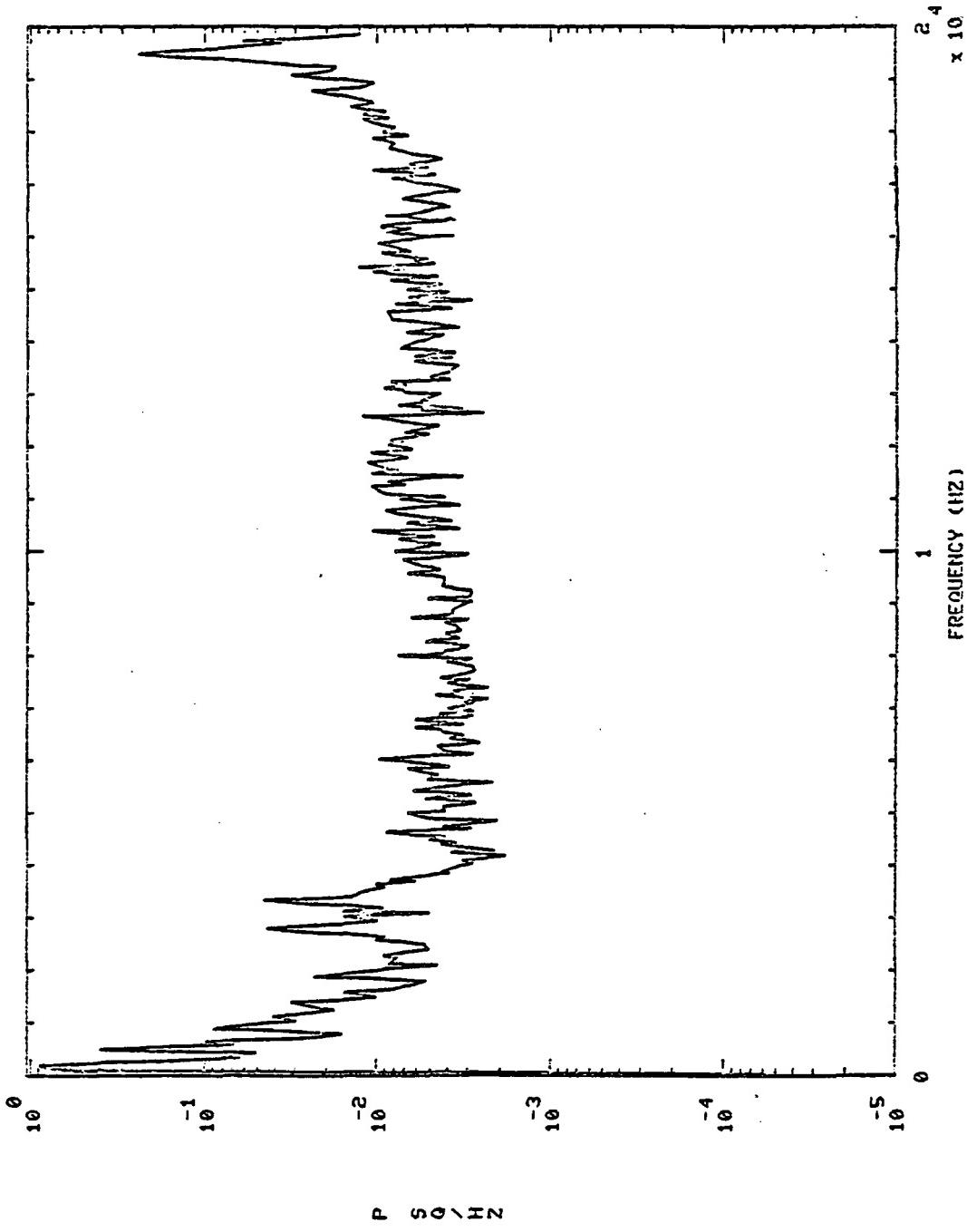
S+ 70.01H0, 'S

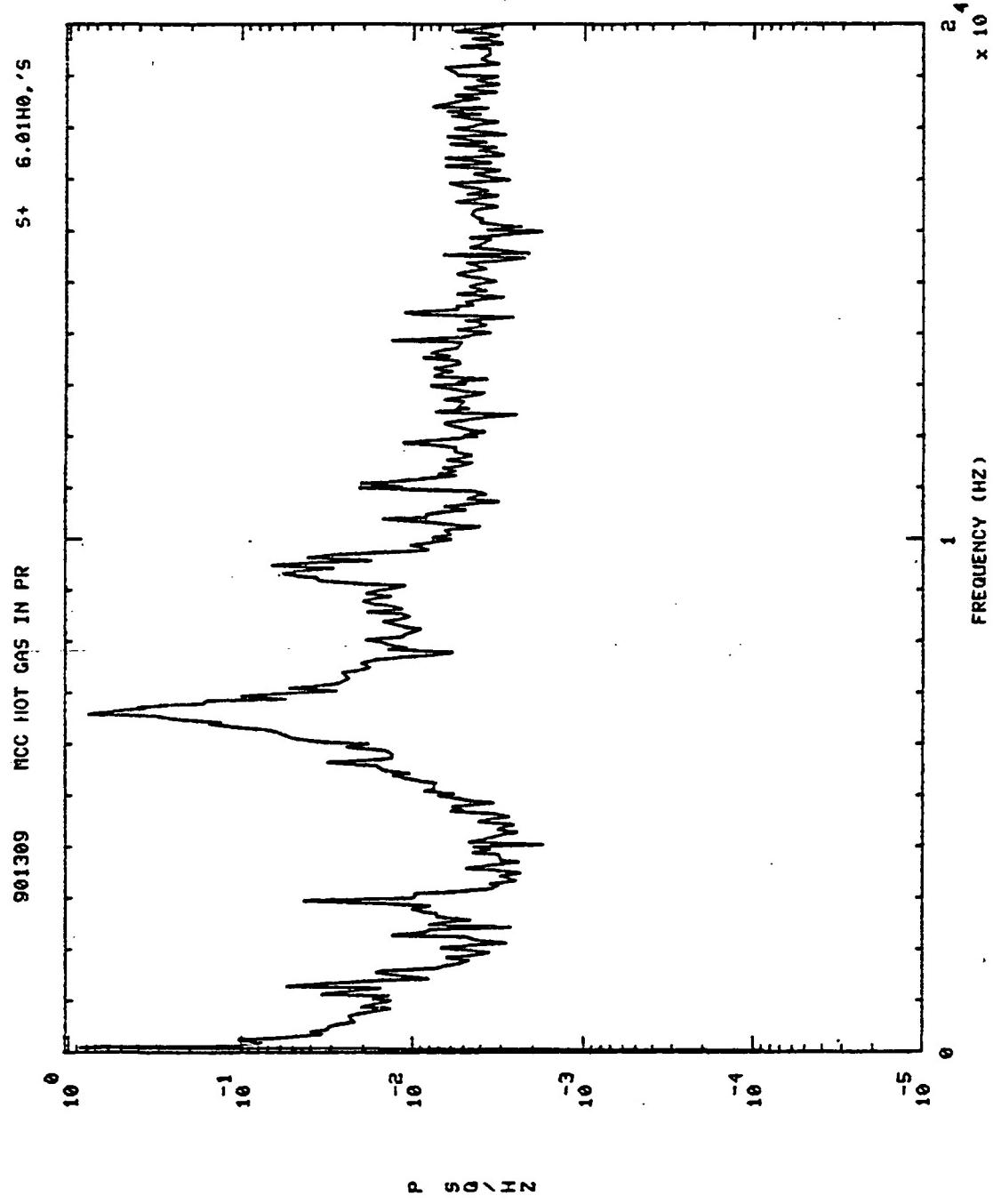




961309 HP0P DS PR

St 30.0110, S

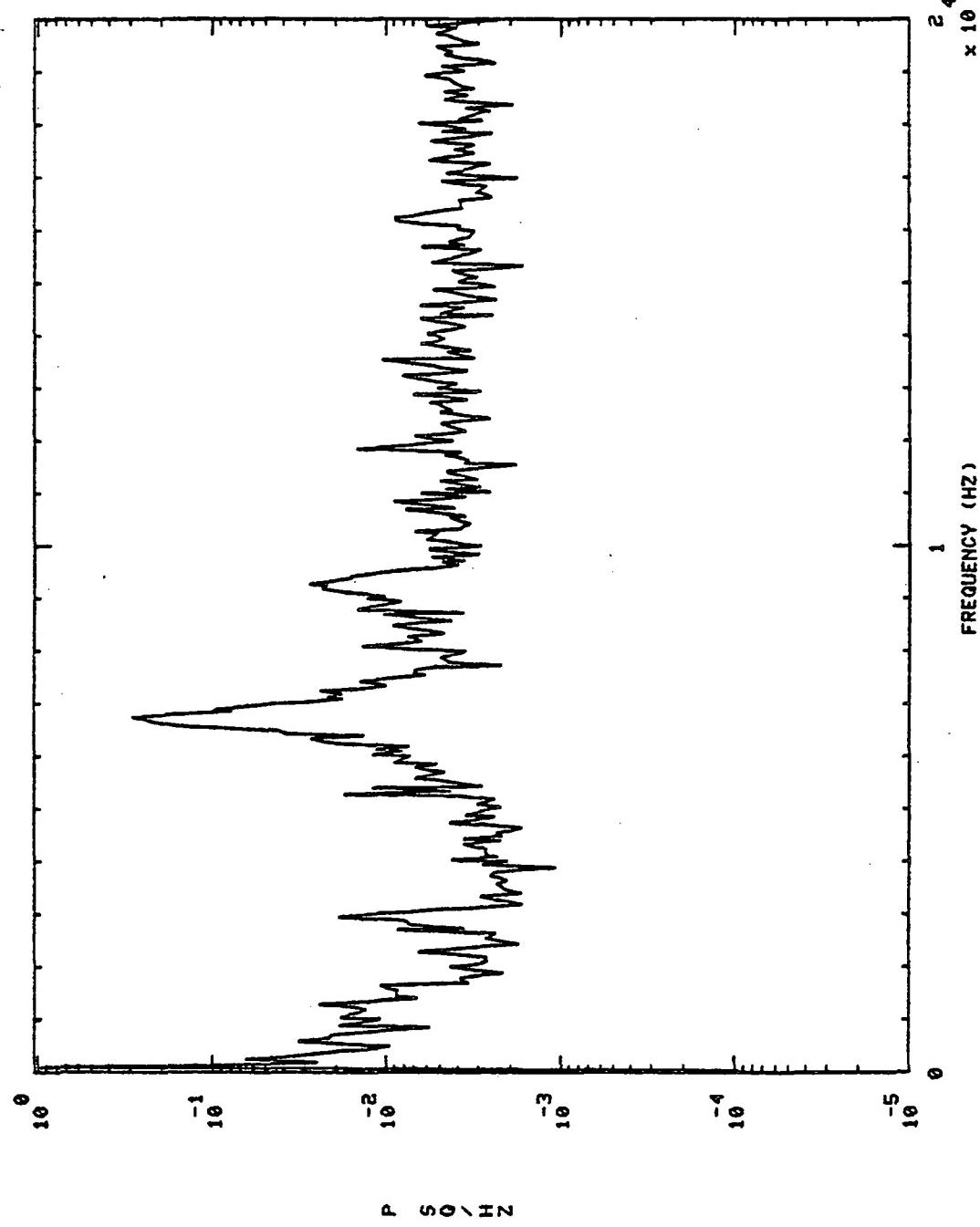




S+ 24.01H0, '6

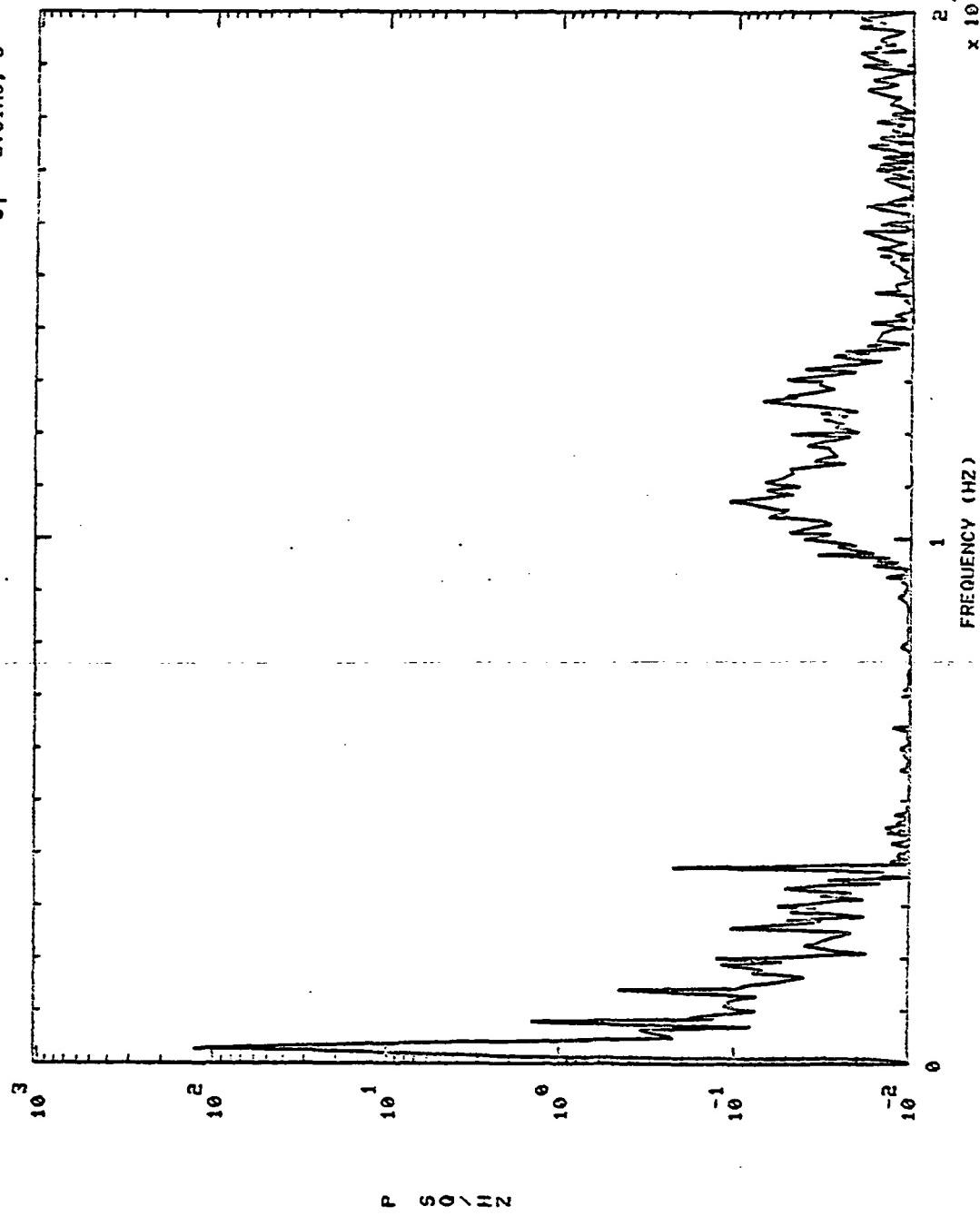
MCC HOT GAS IN PR

901309

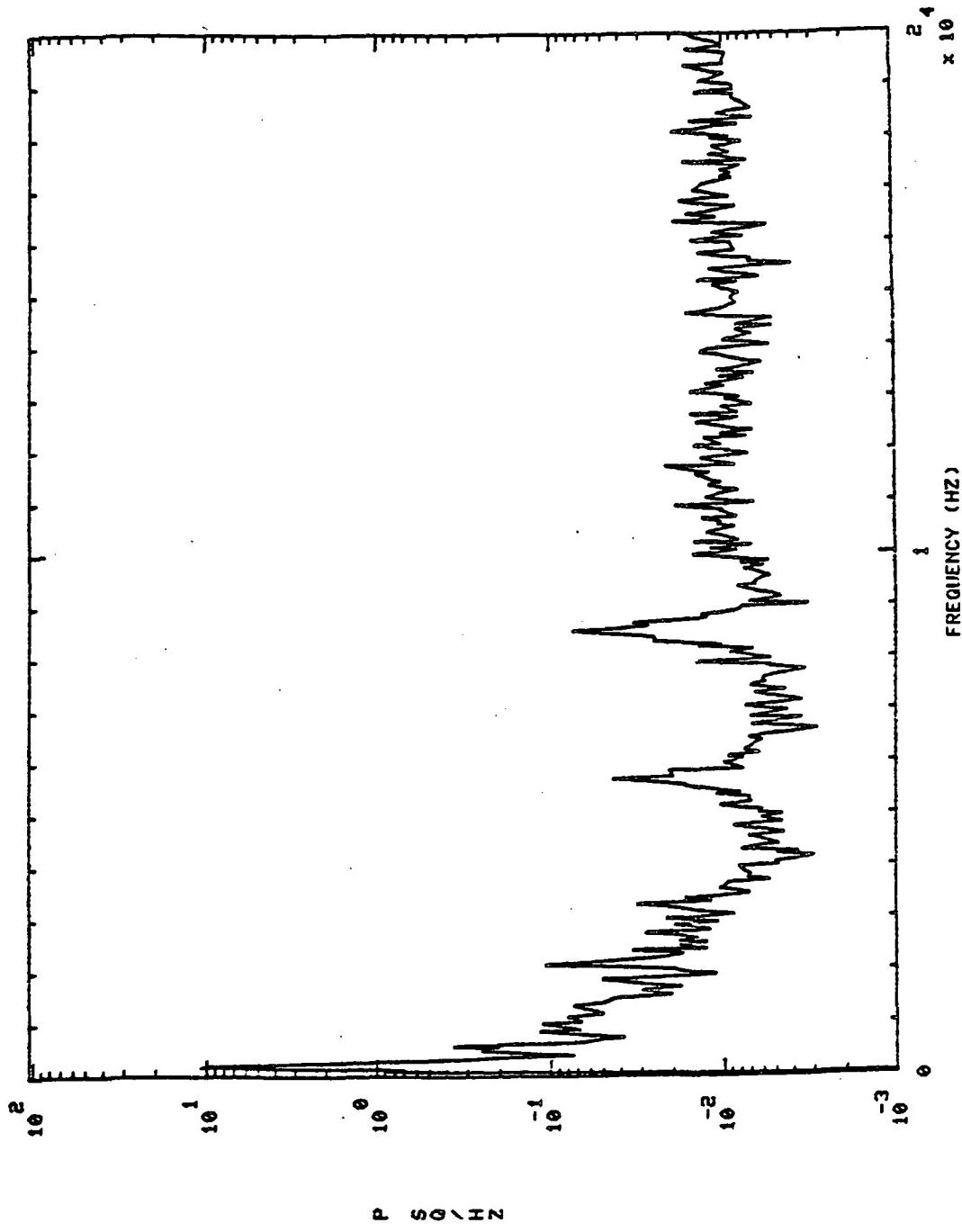


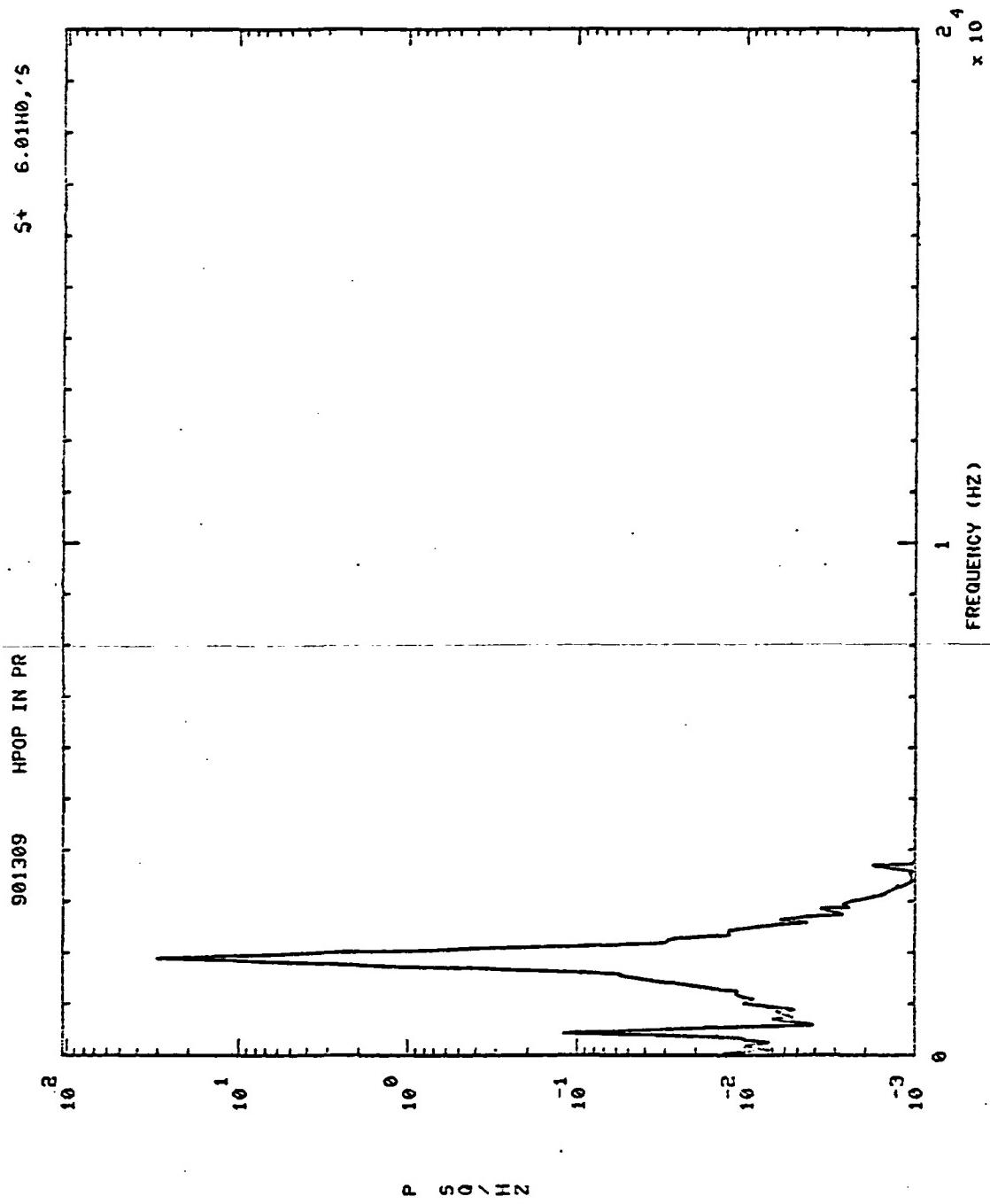
901309 PBP DS PR

St 6.01H0.'S



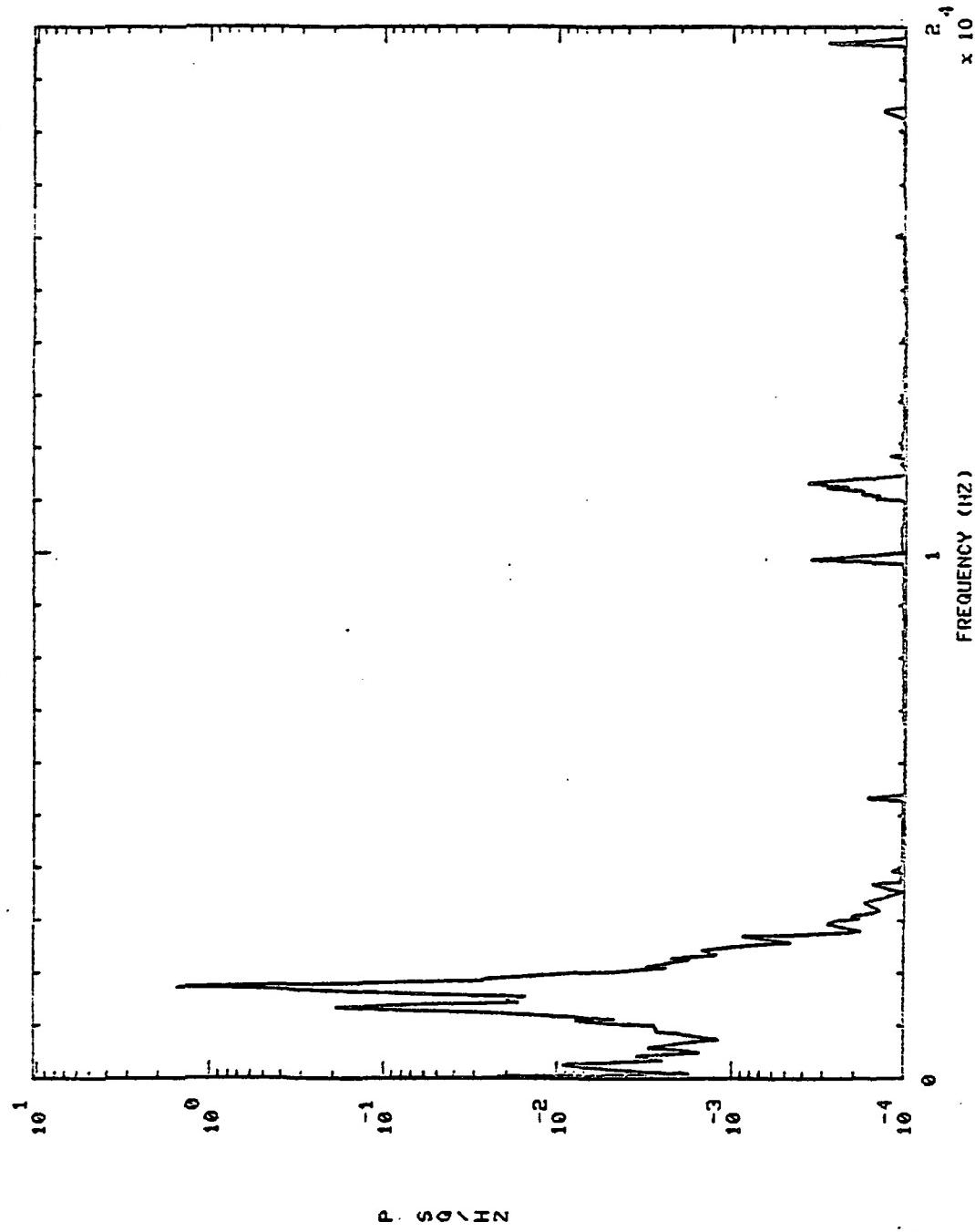
901309 PBP DS PR S+ 30.0

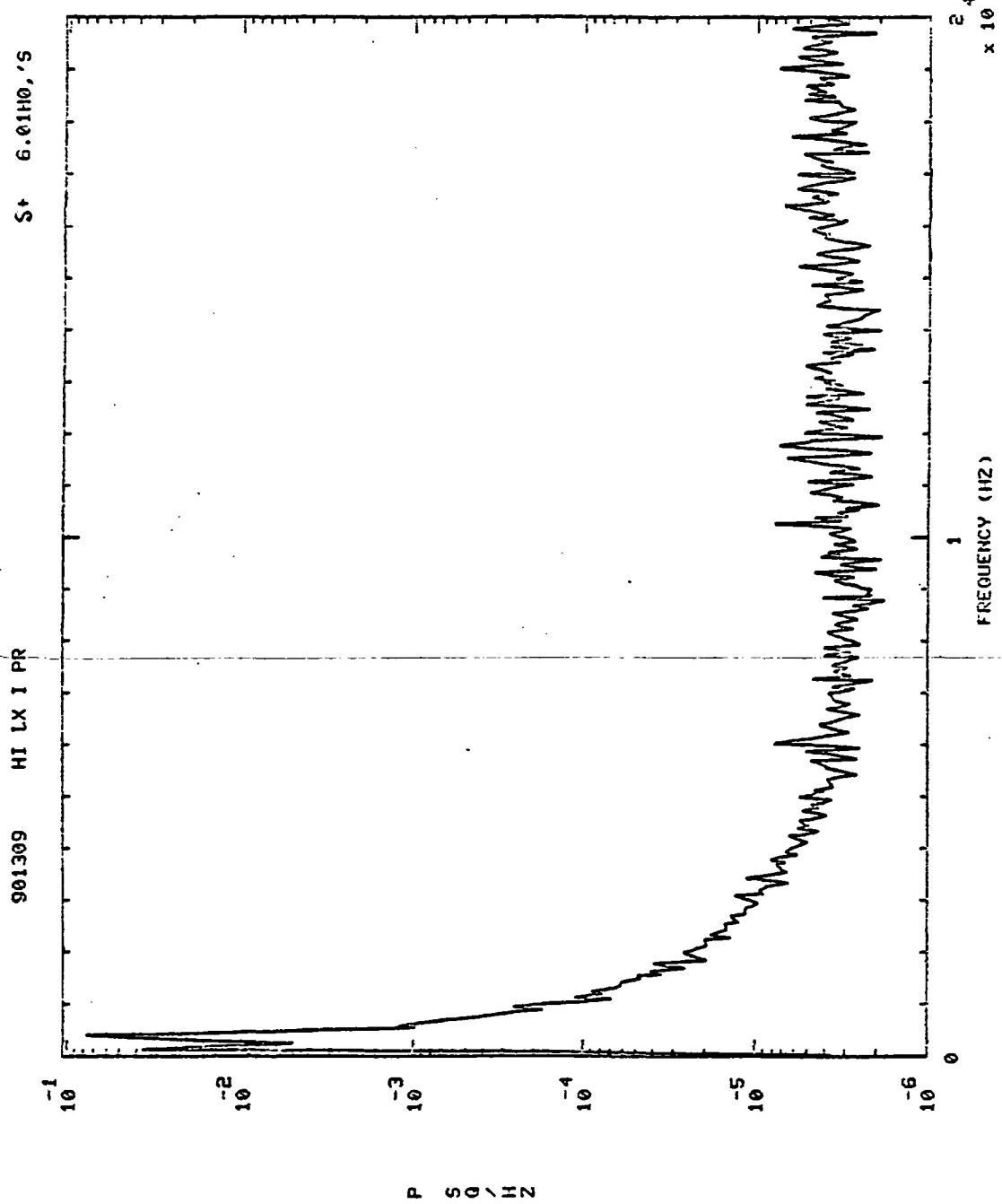




901309 HPOP IN PR

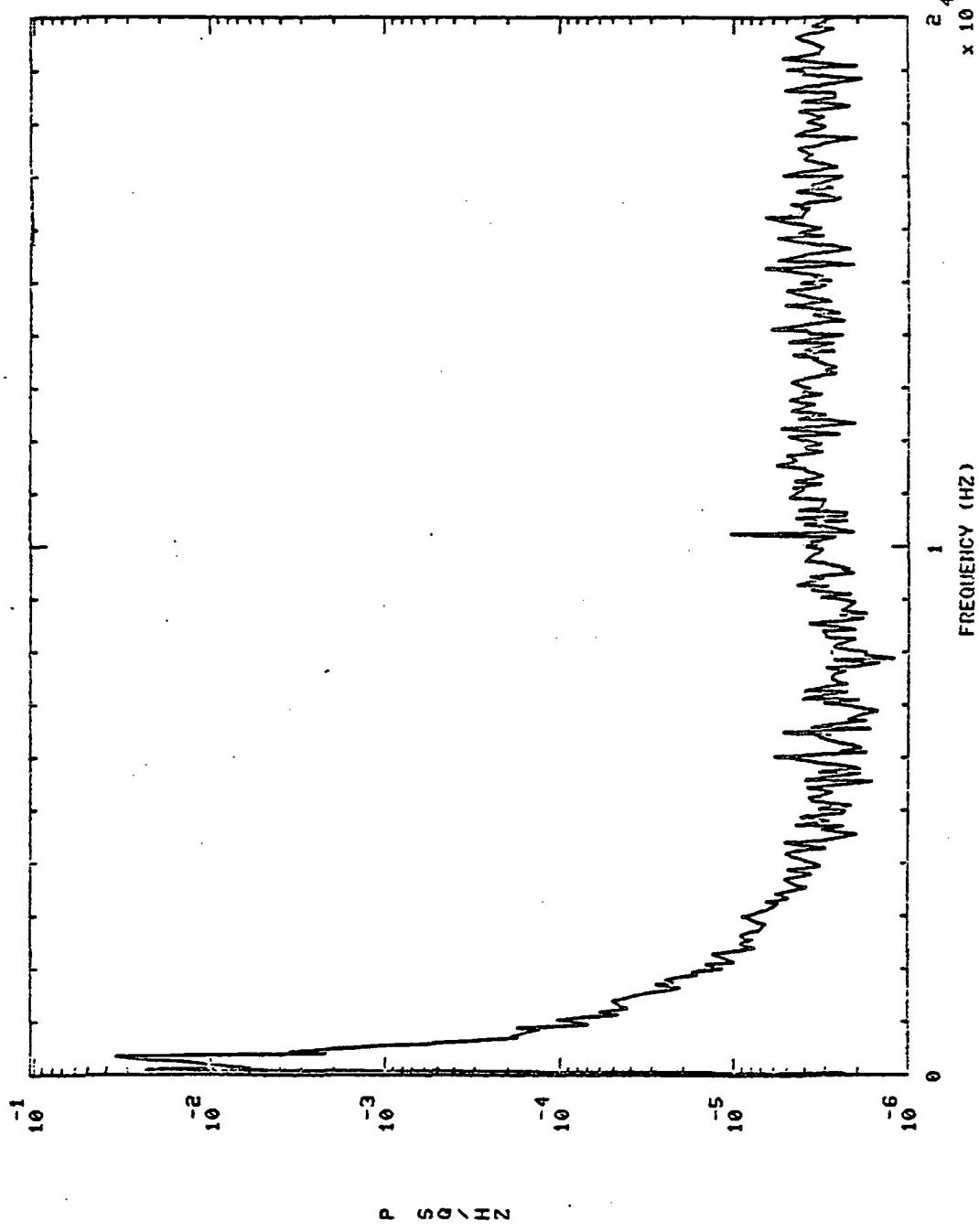
St 24.01H0, 'S

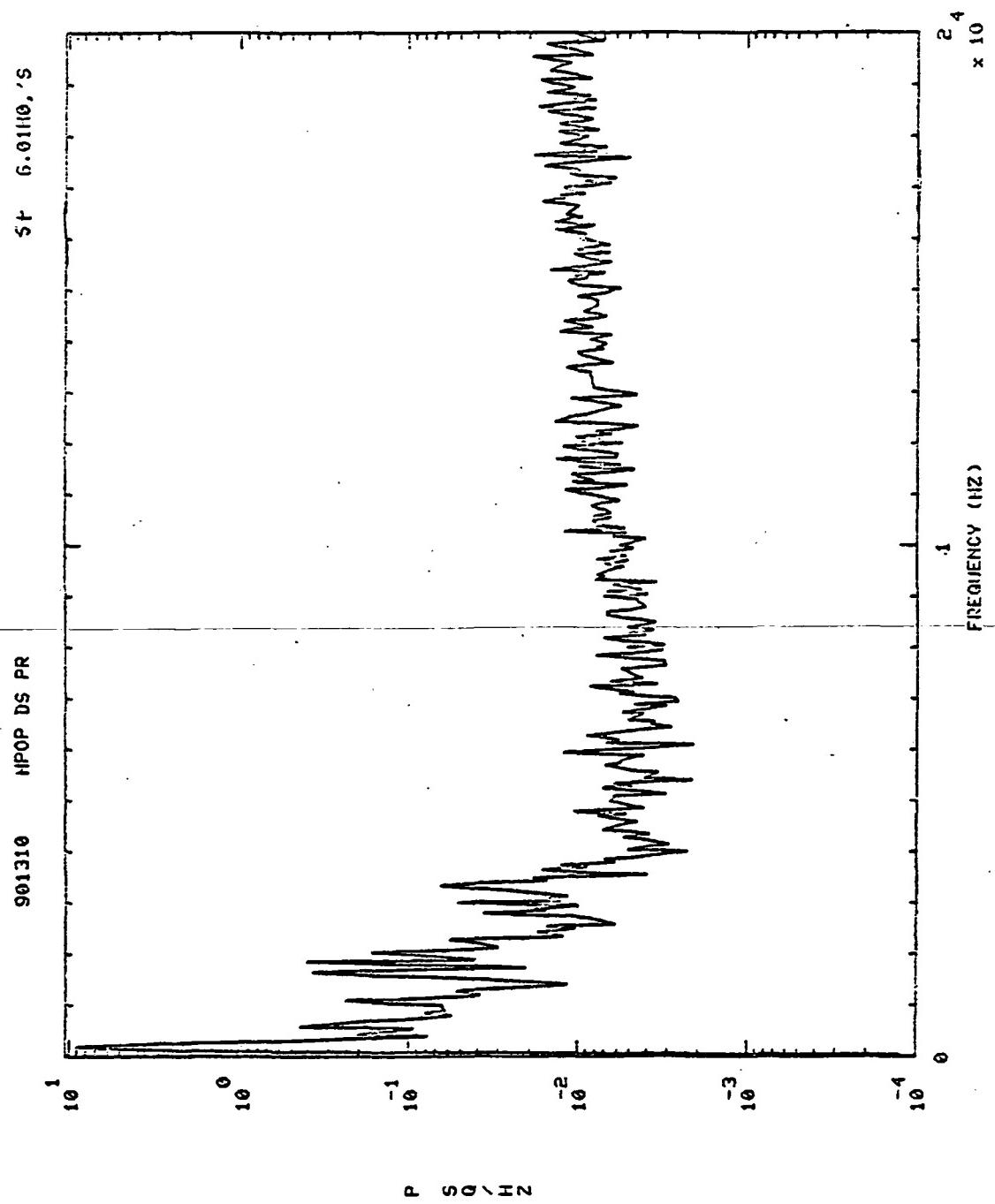




St 24.01H0.'5

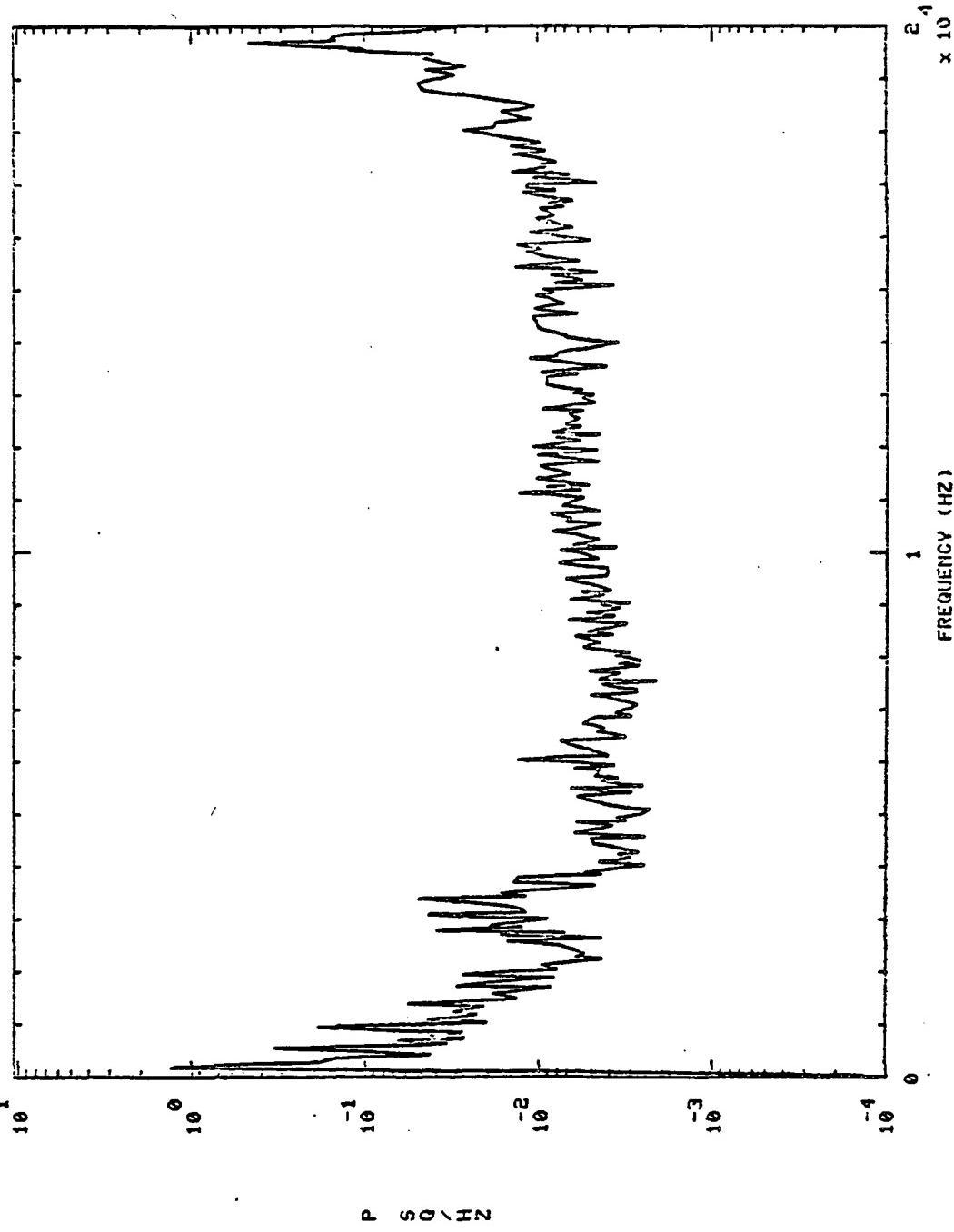
901309 HI LX I PR

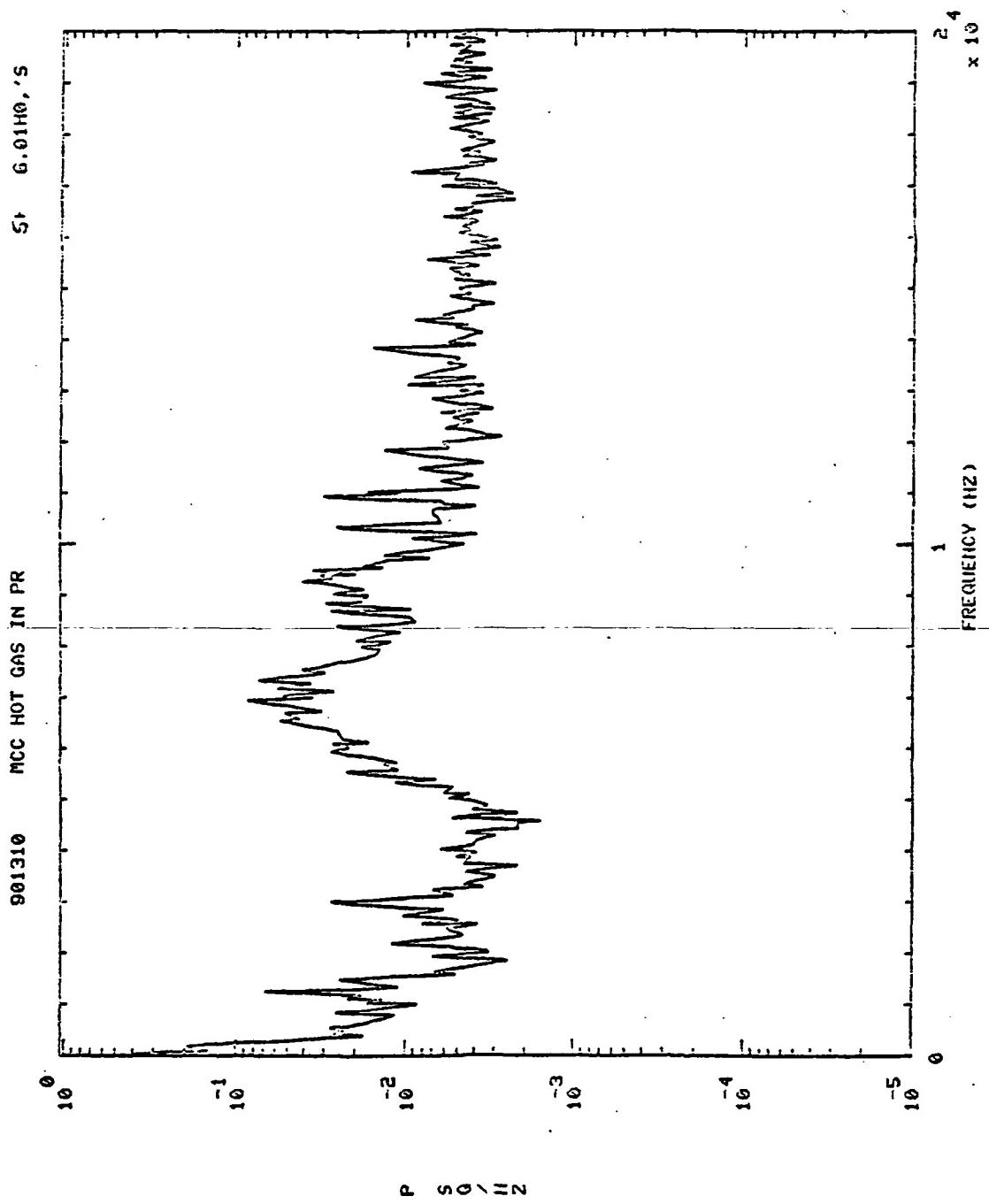




9001310 HPOP DS PR

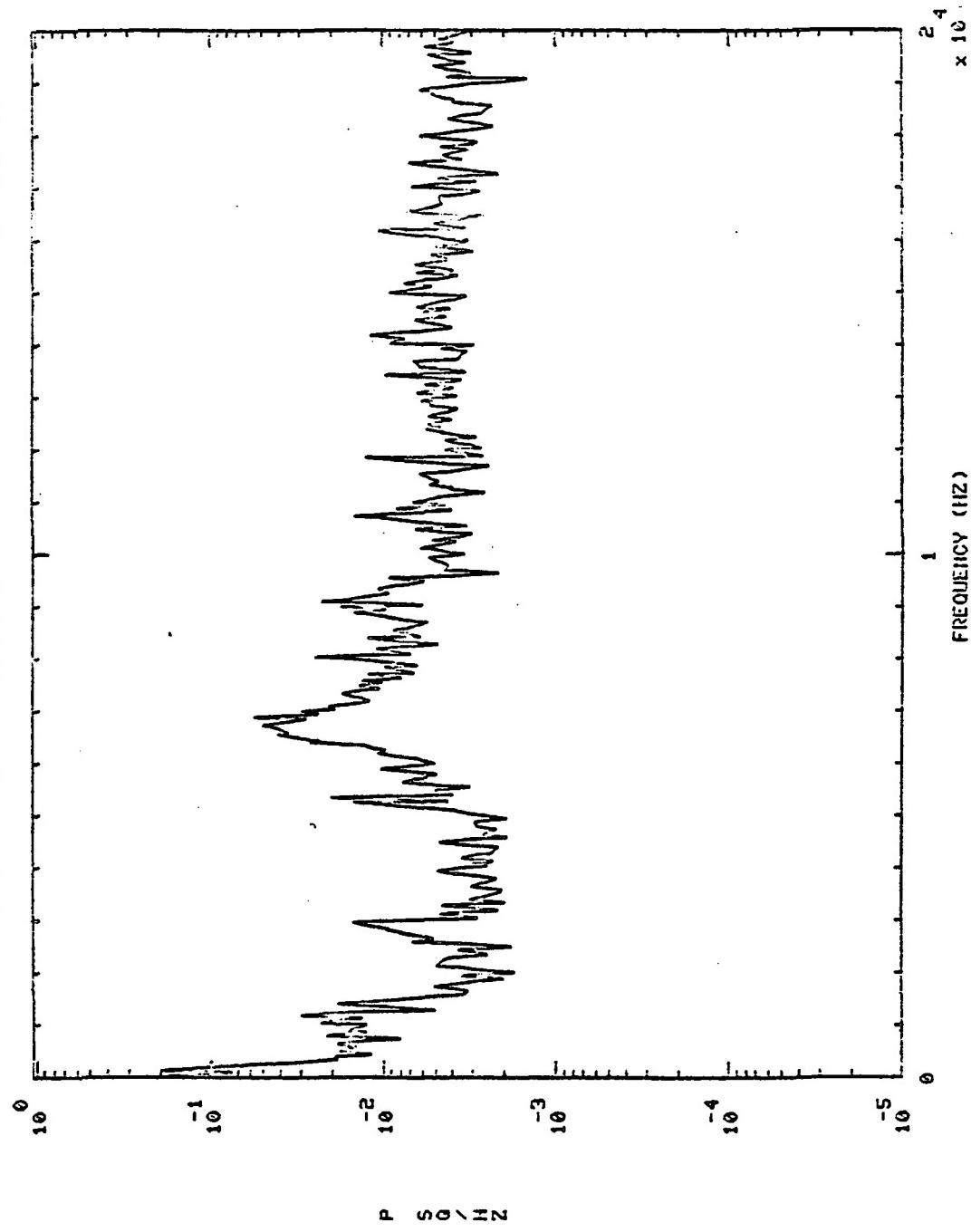
S+ 30.01H0, S

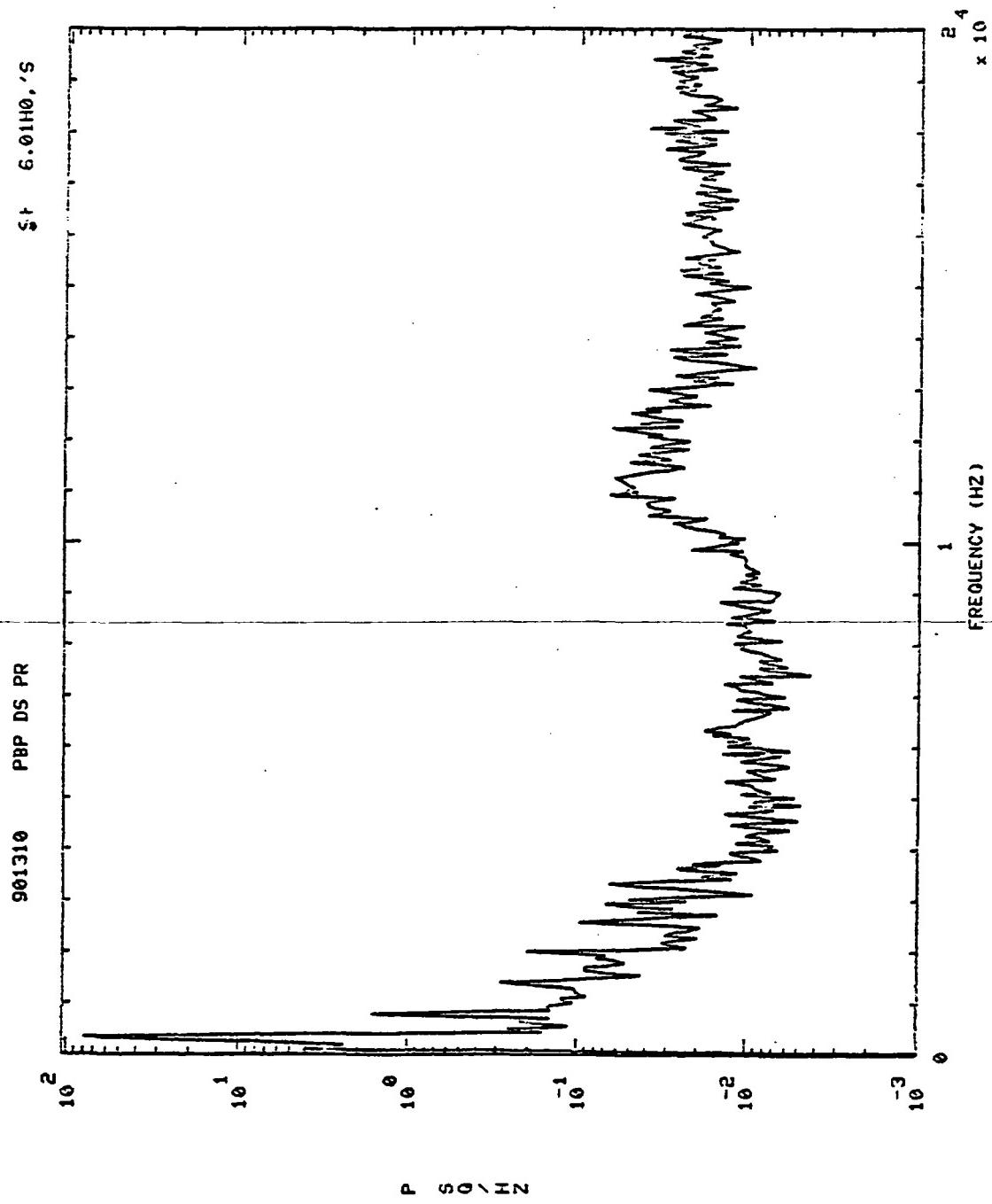




901310 MCC HOT GAS IN PR

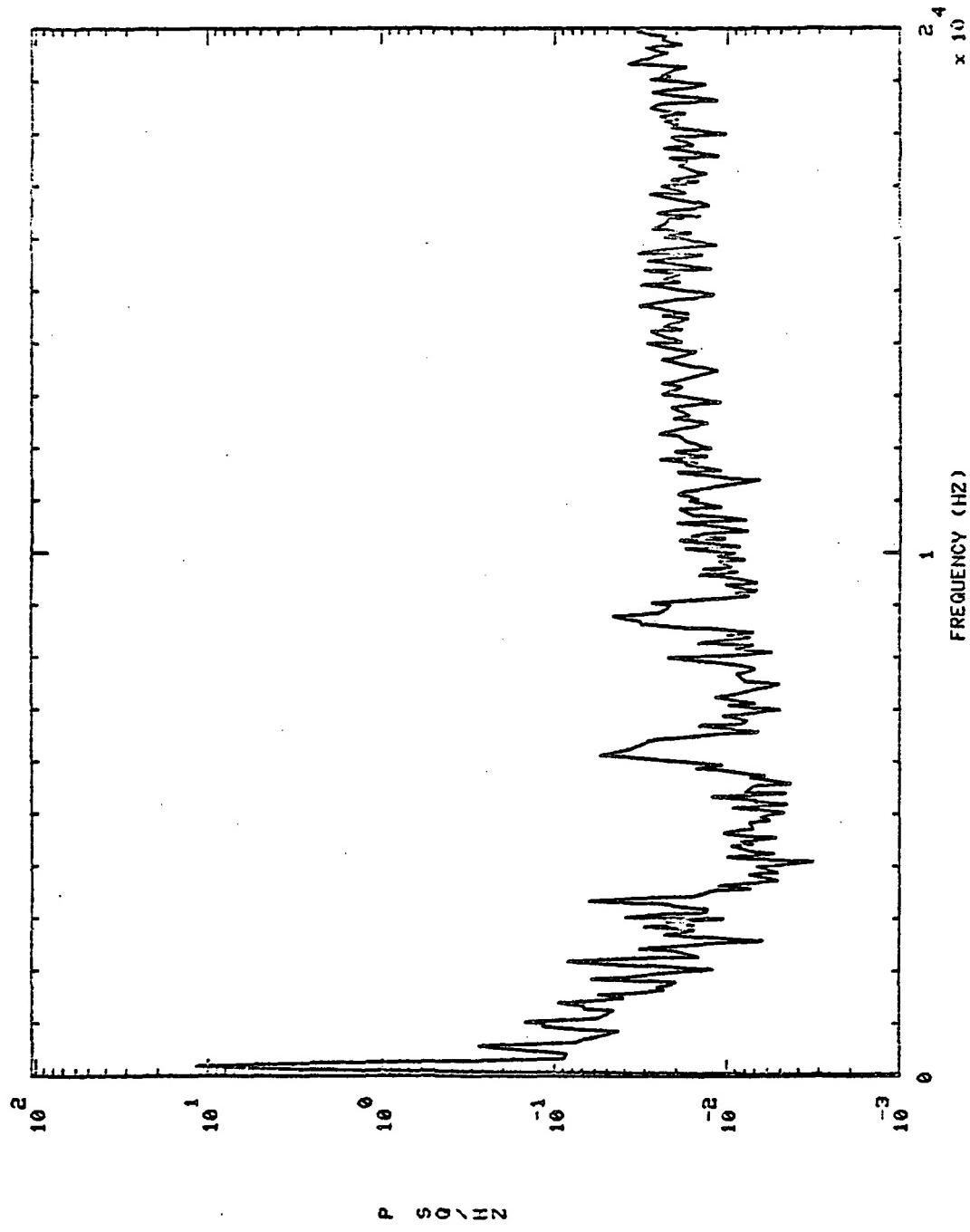
ST 33.0110, S

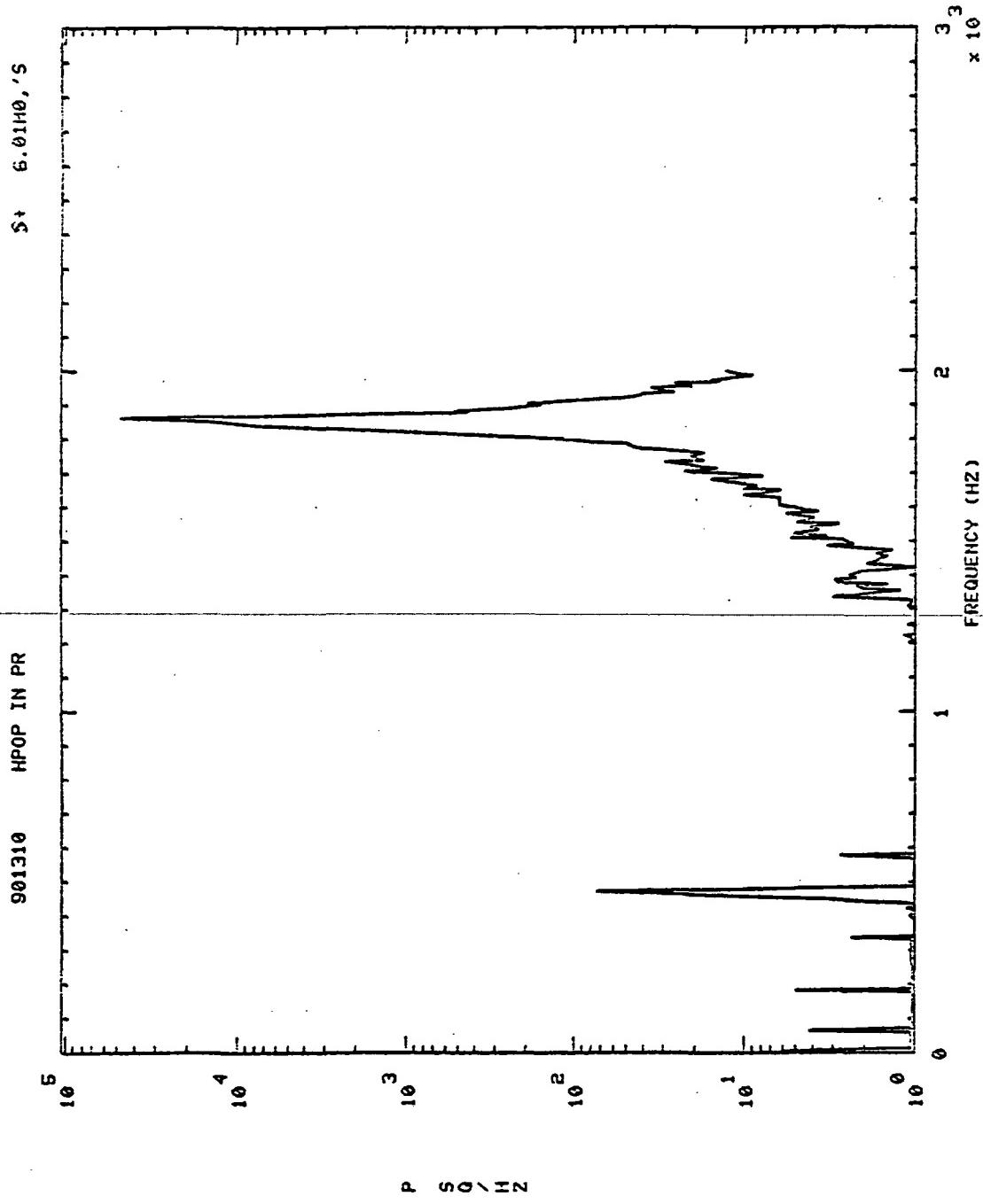




51 30.01H0.'S

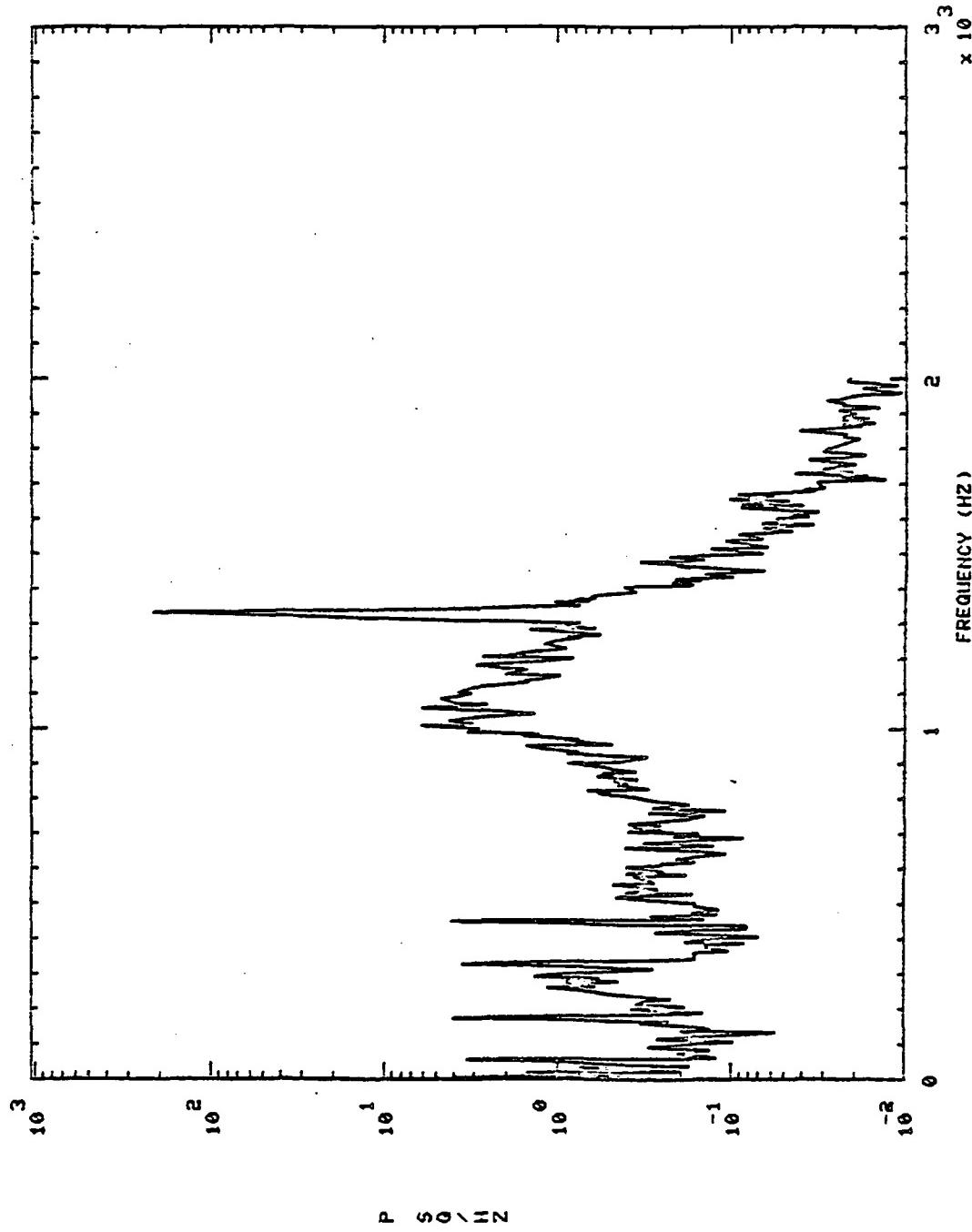
901310 PBP DS PR

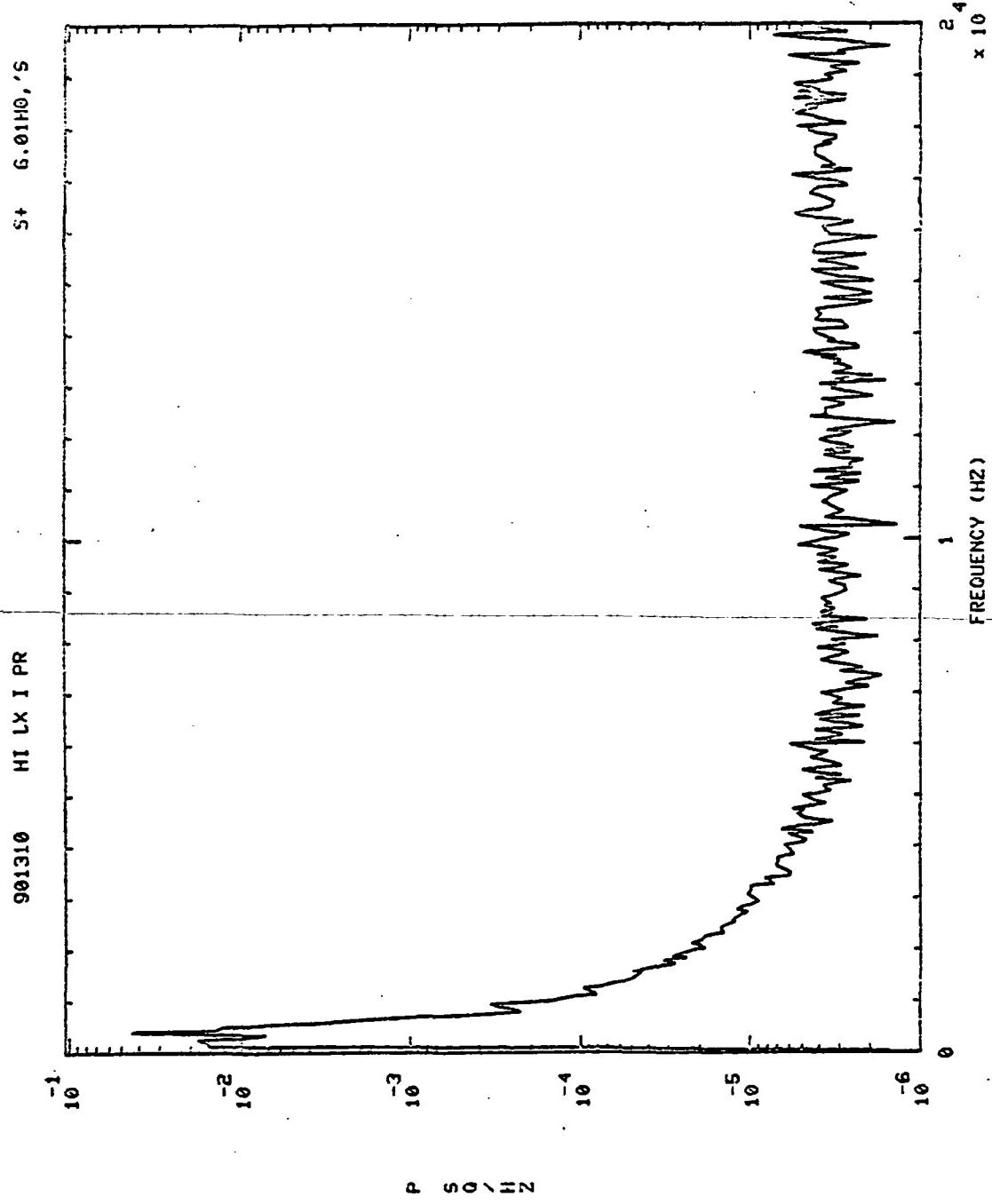




901310 HPOP IN PR

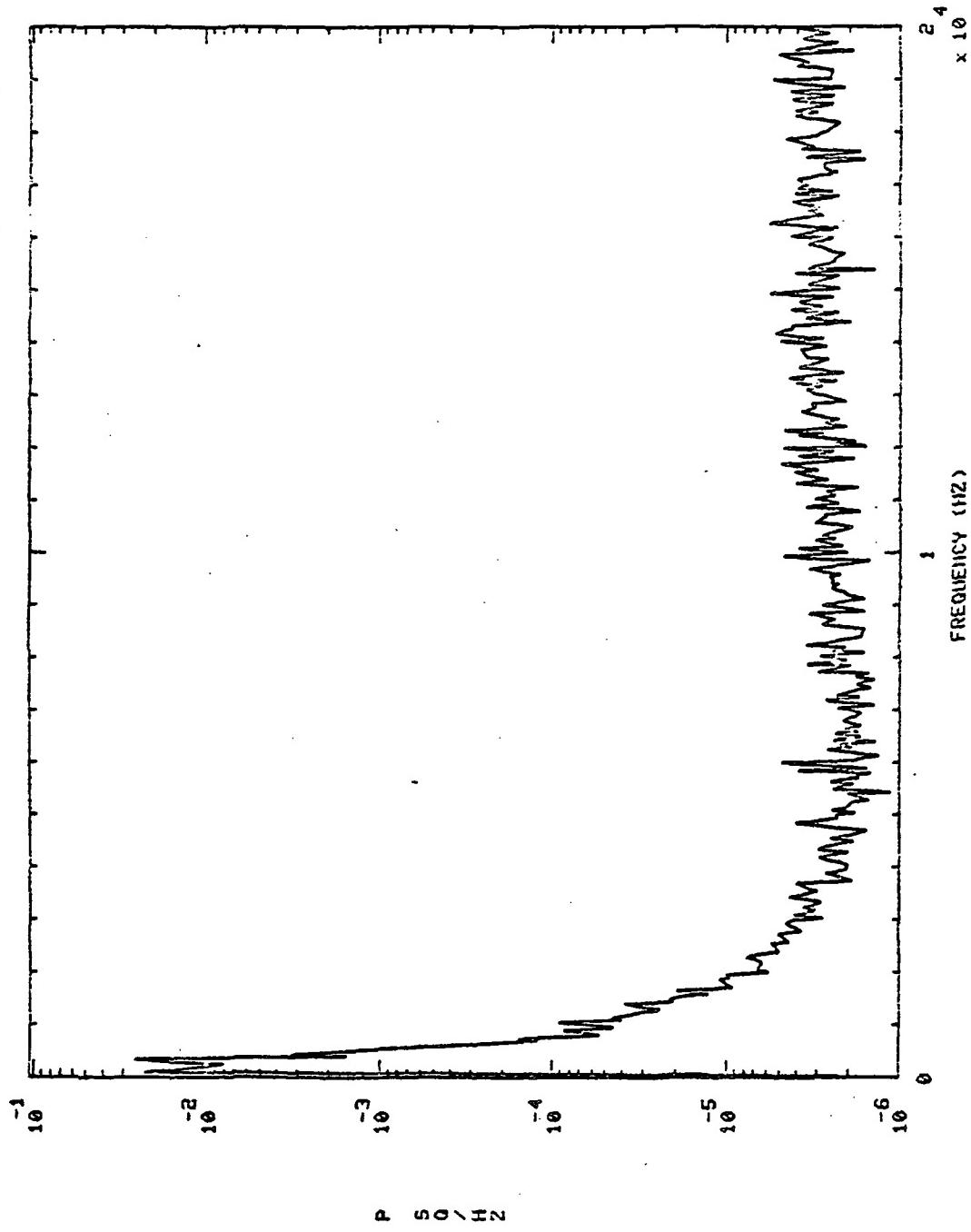
St 30.0110, S

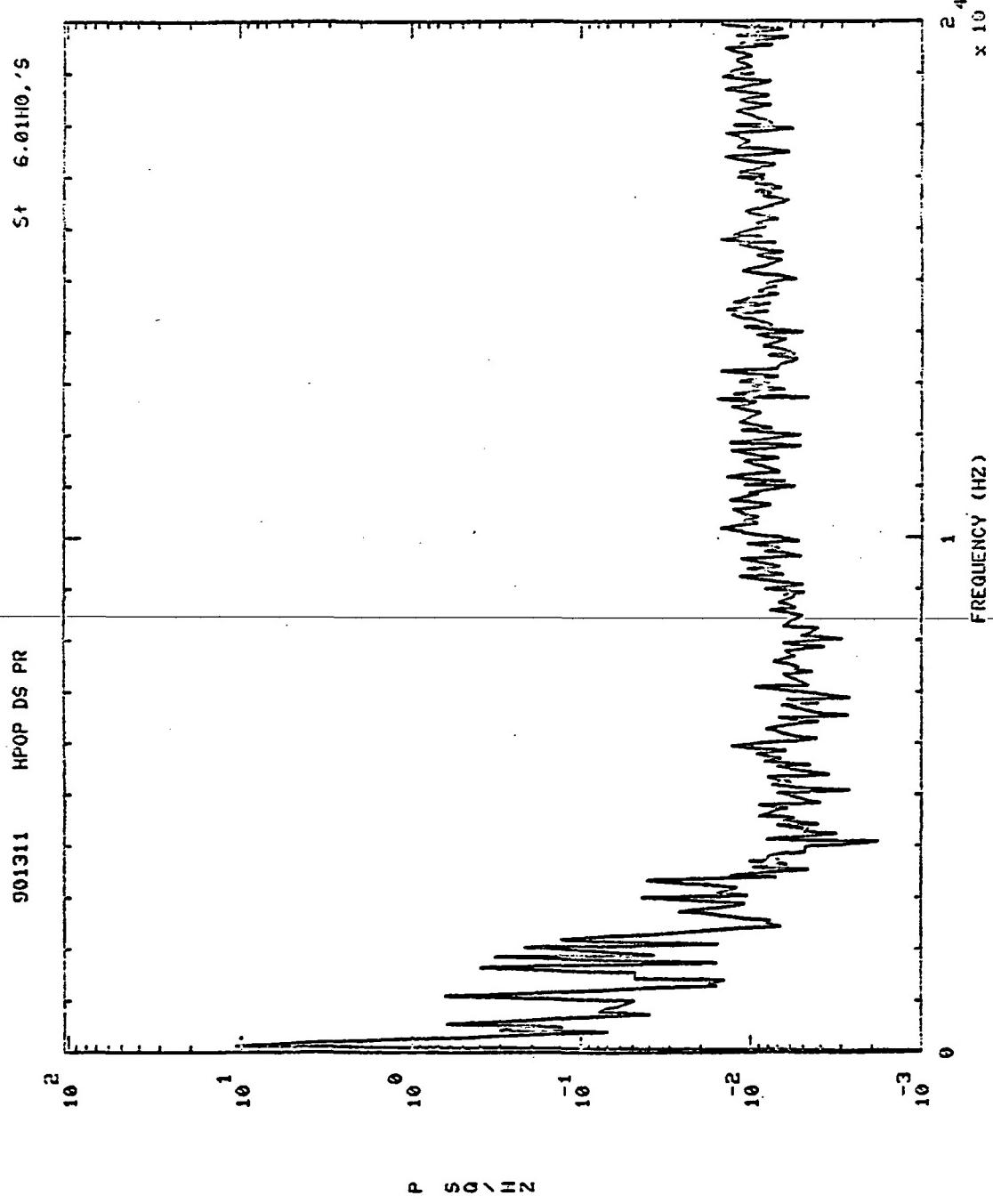




S-1 30.01H0, S

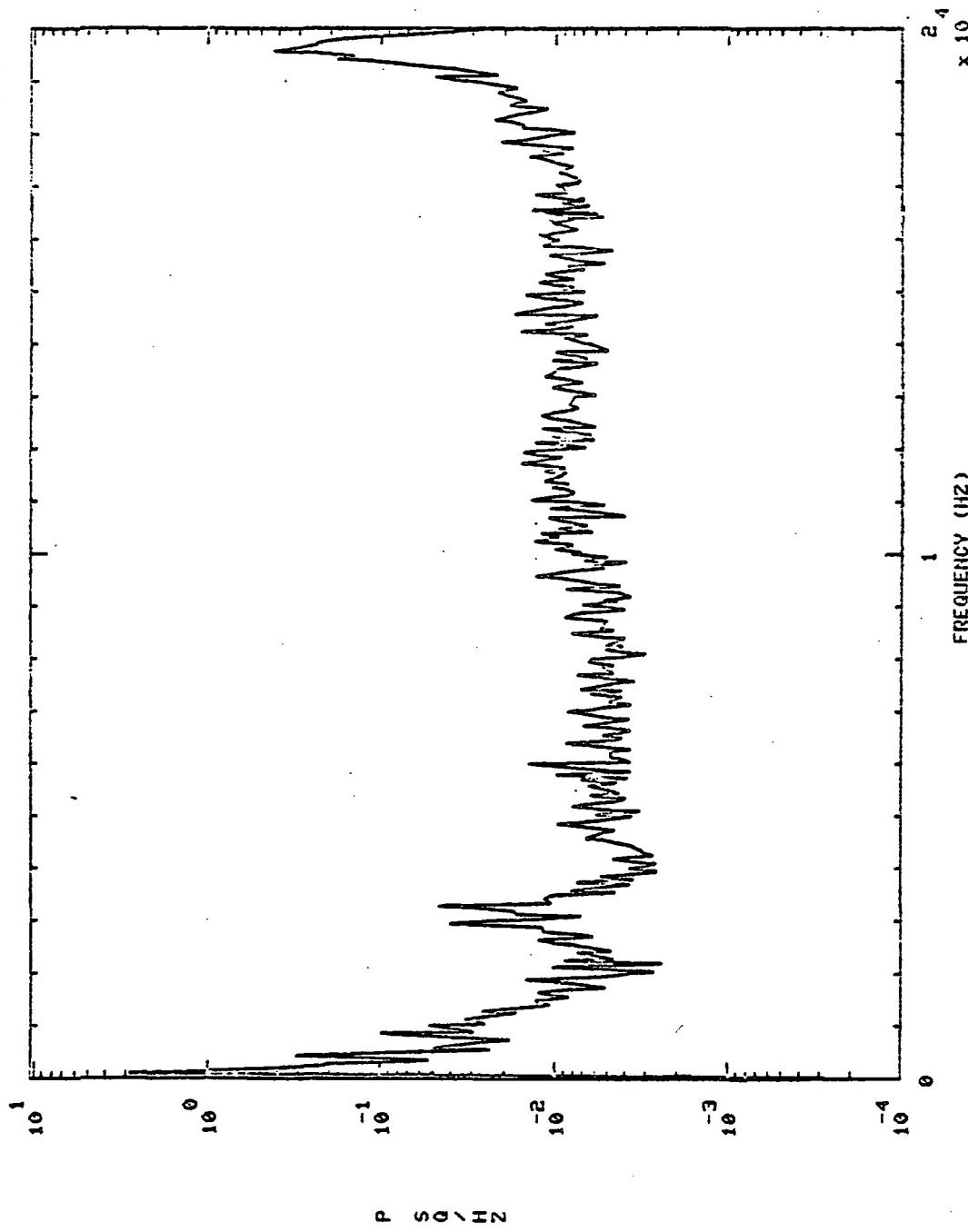
901310 HI LX I PR





Sr = 30.01H0./s

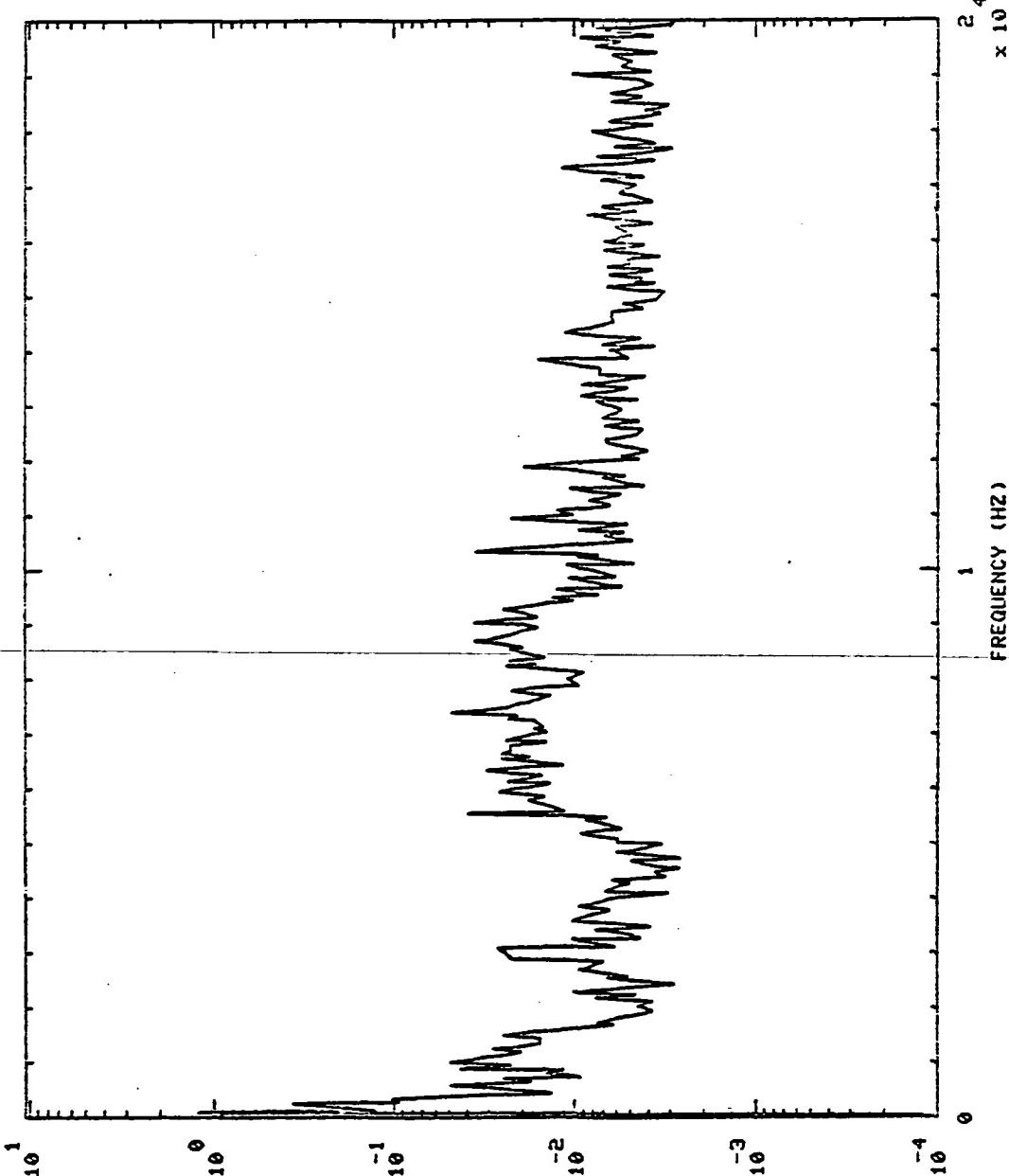
901311 HPOP DS PR



901311 MCC HOT GAS IN PR

S+ 6.011H0, S

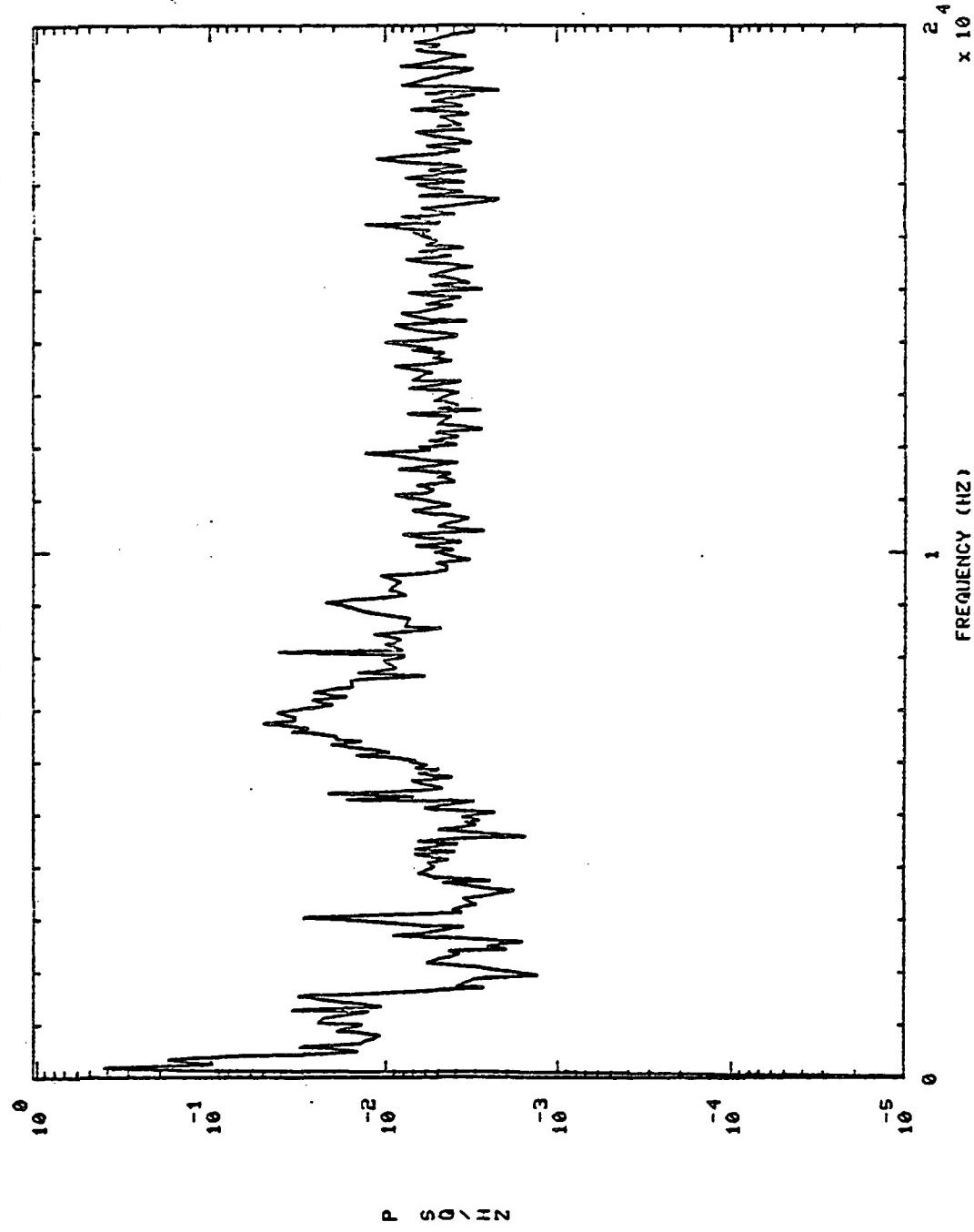
P S Q / Hz



$\times 10^4$
FREQUENCY (Hz)

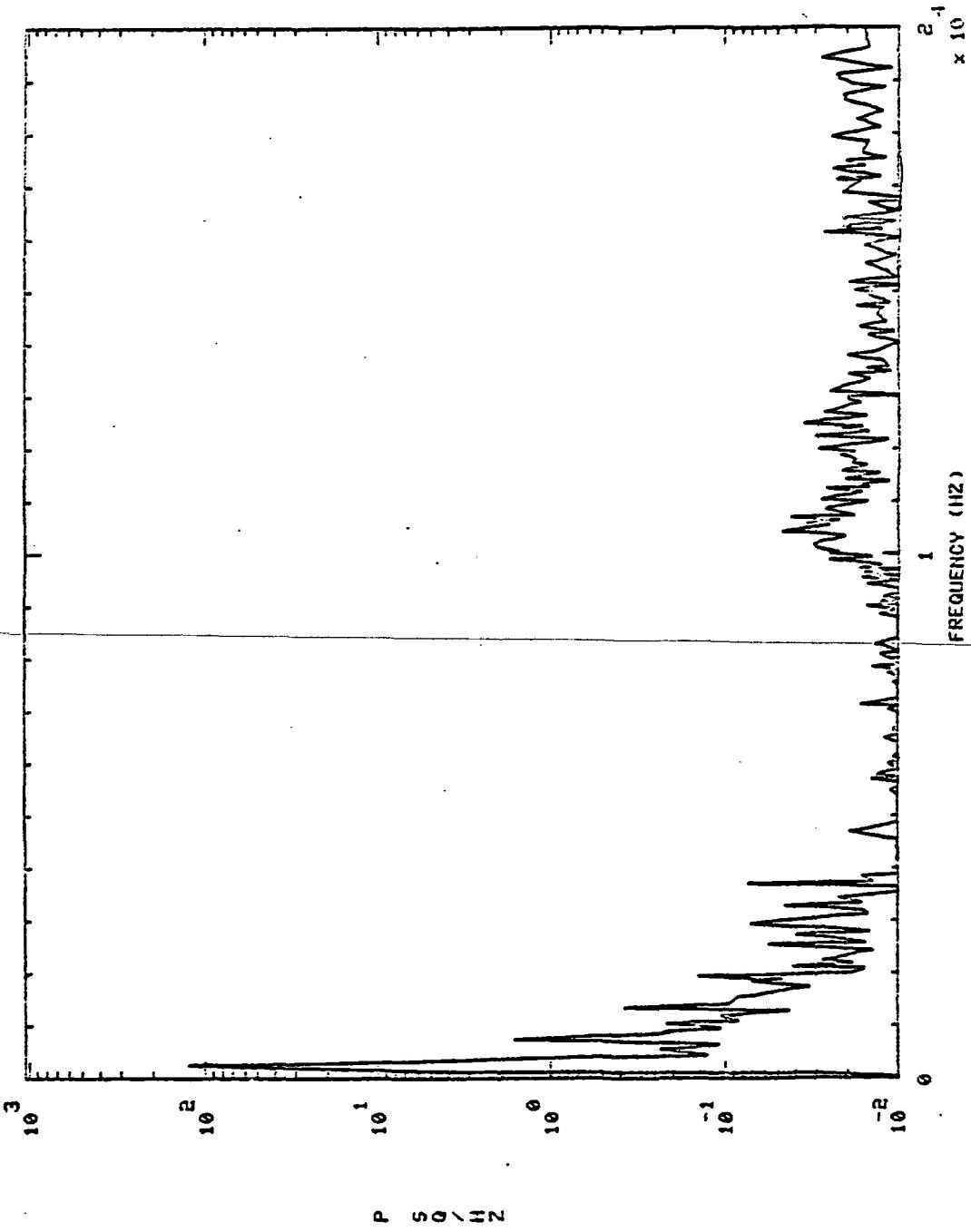
901311 MCC HOT GAS IN PR

S+ 30.01H0.5



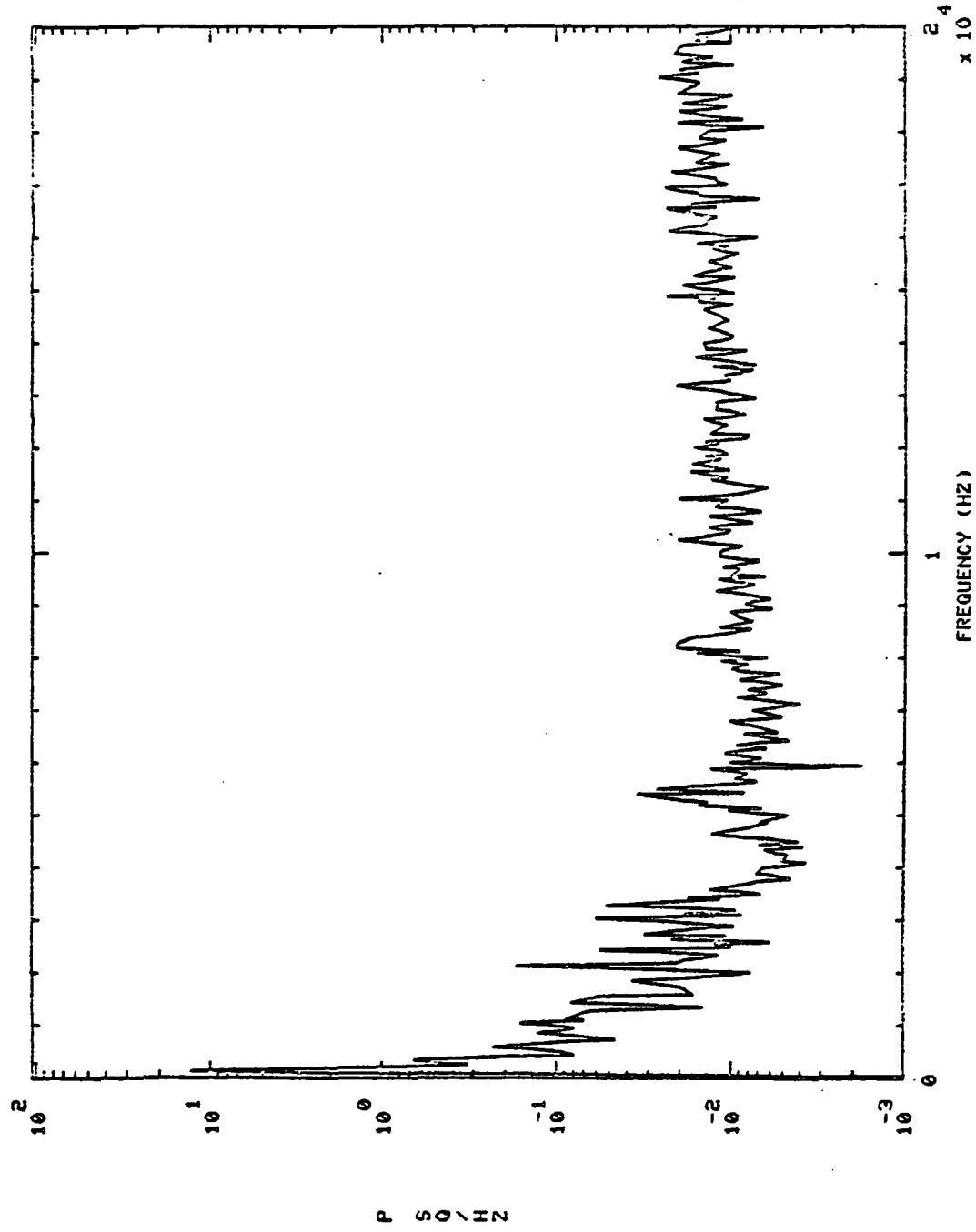
901311 PBP DS PR

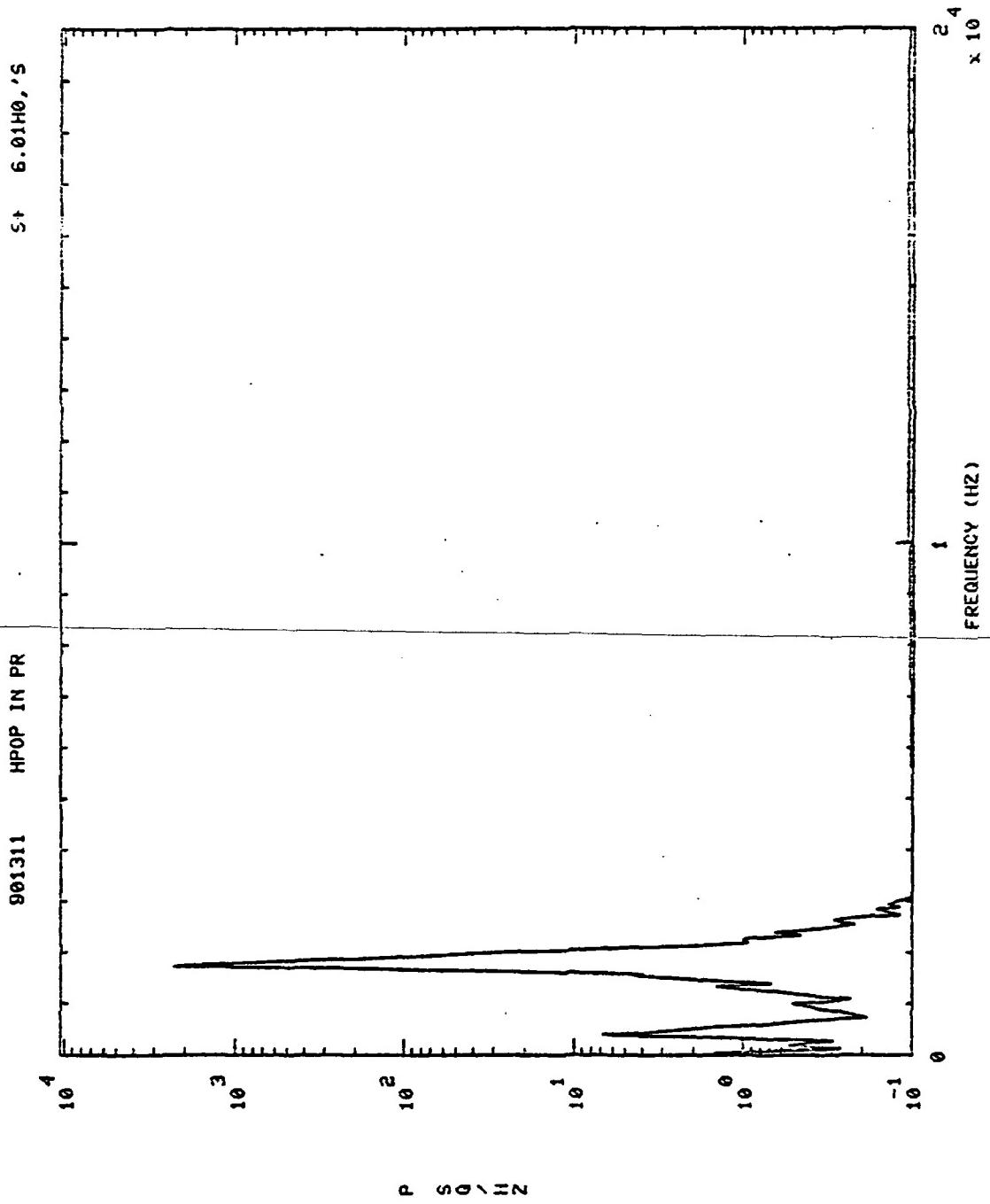
S4 6.01H0.'S

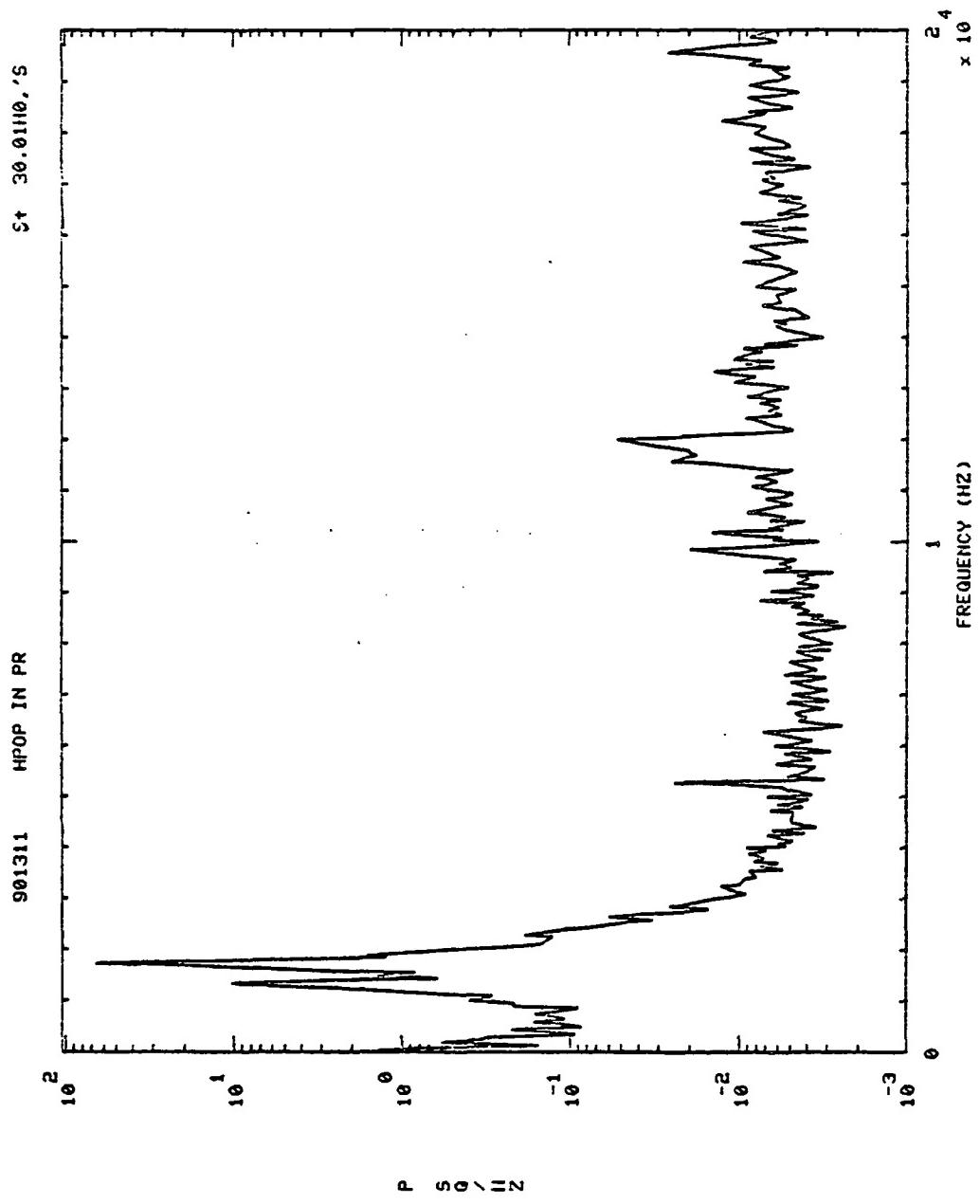


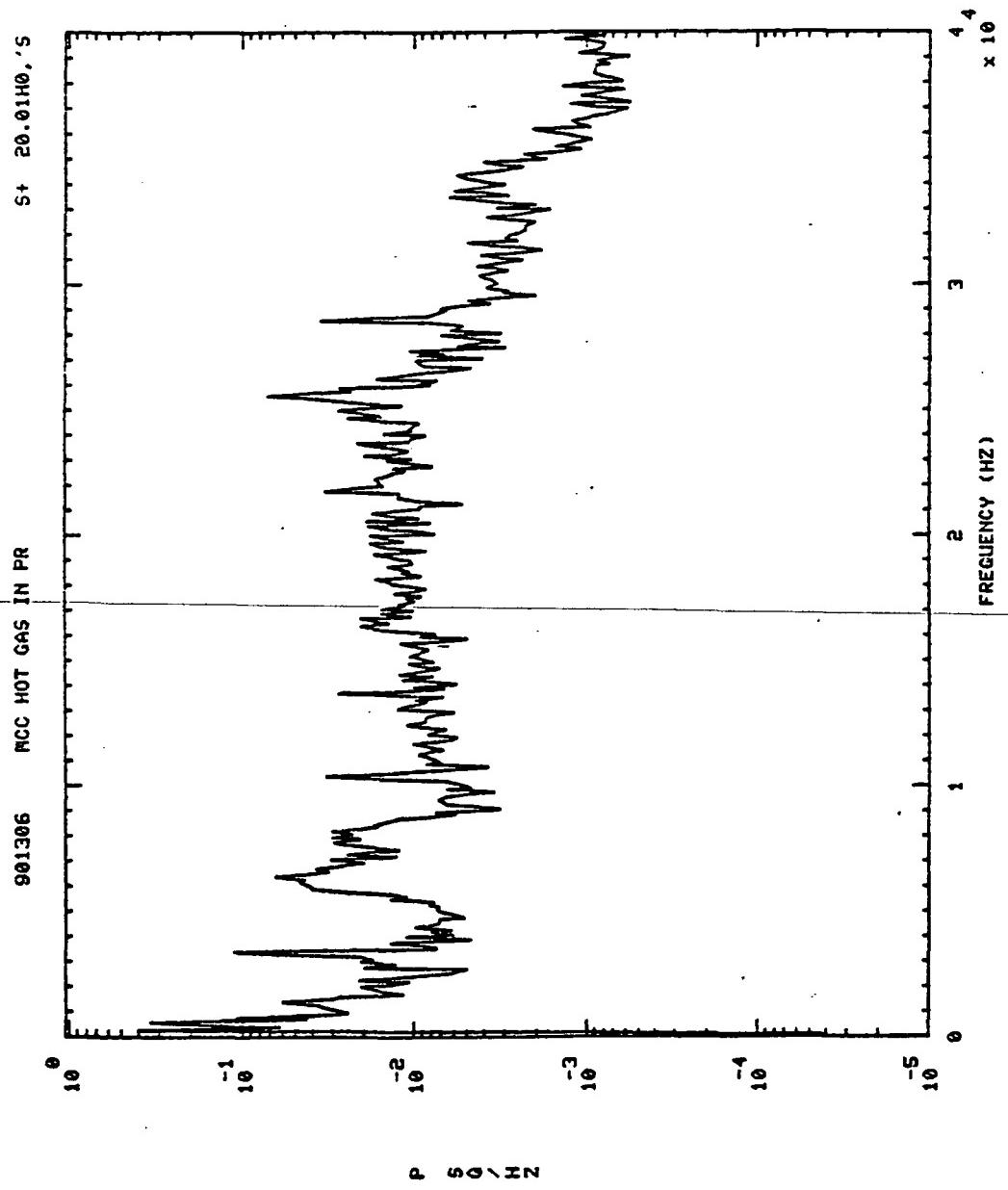
S+ 30.01H0.'S

901311 PBP DS PR



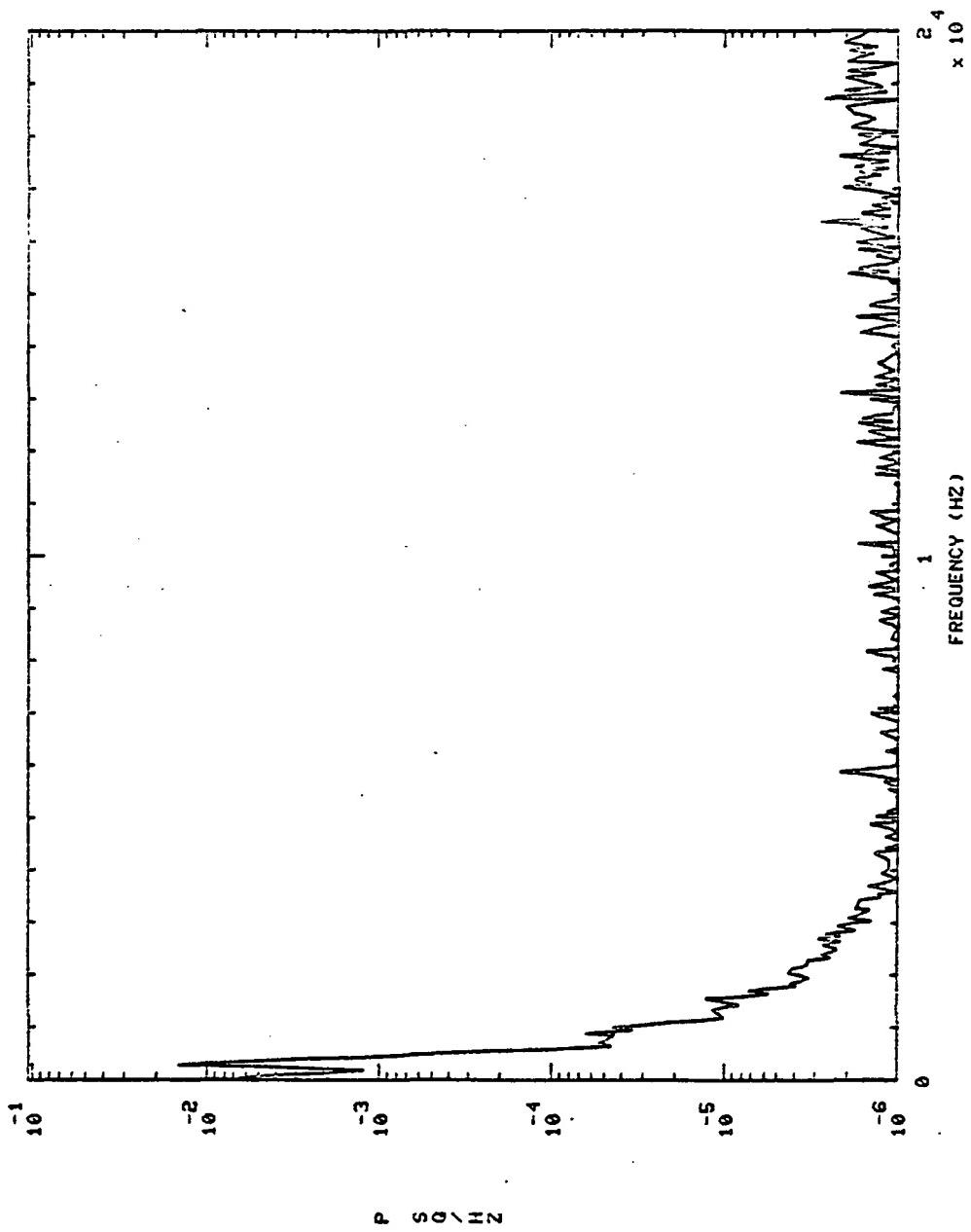


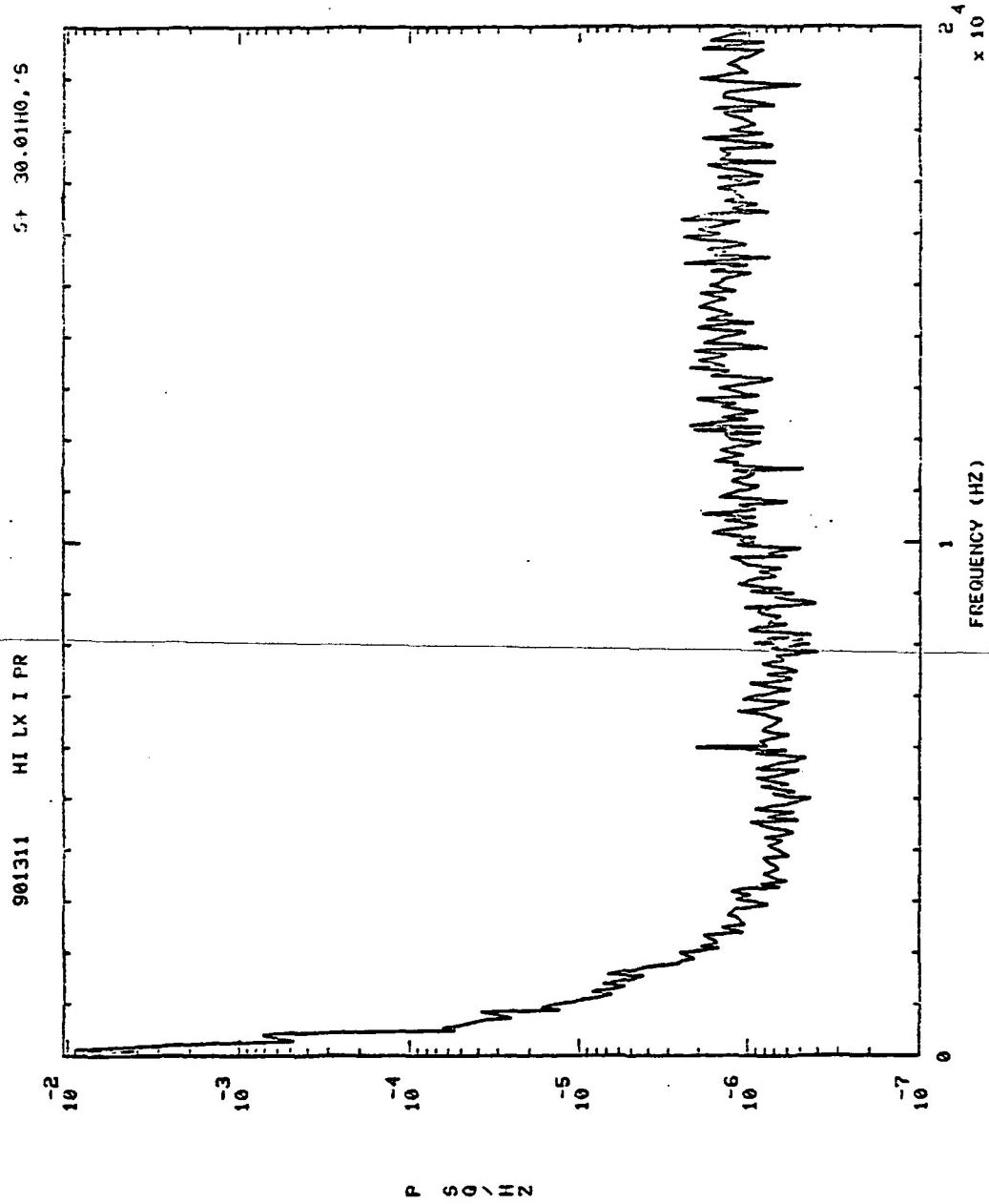




901311 HI LX 1 PR

SA 6.01100 /S





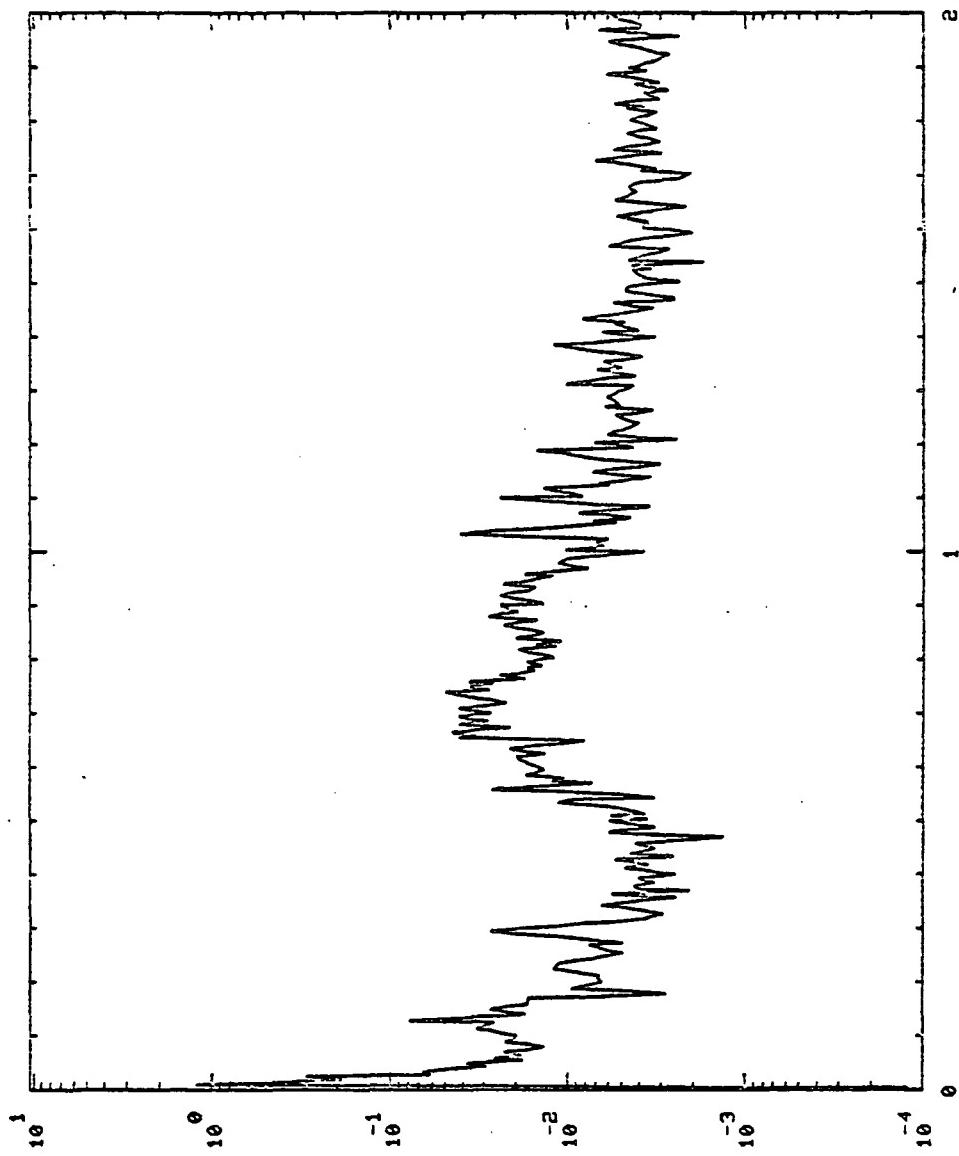
901312 MCC HOT GAS IN PR

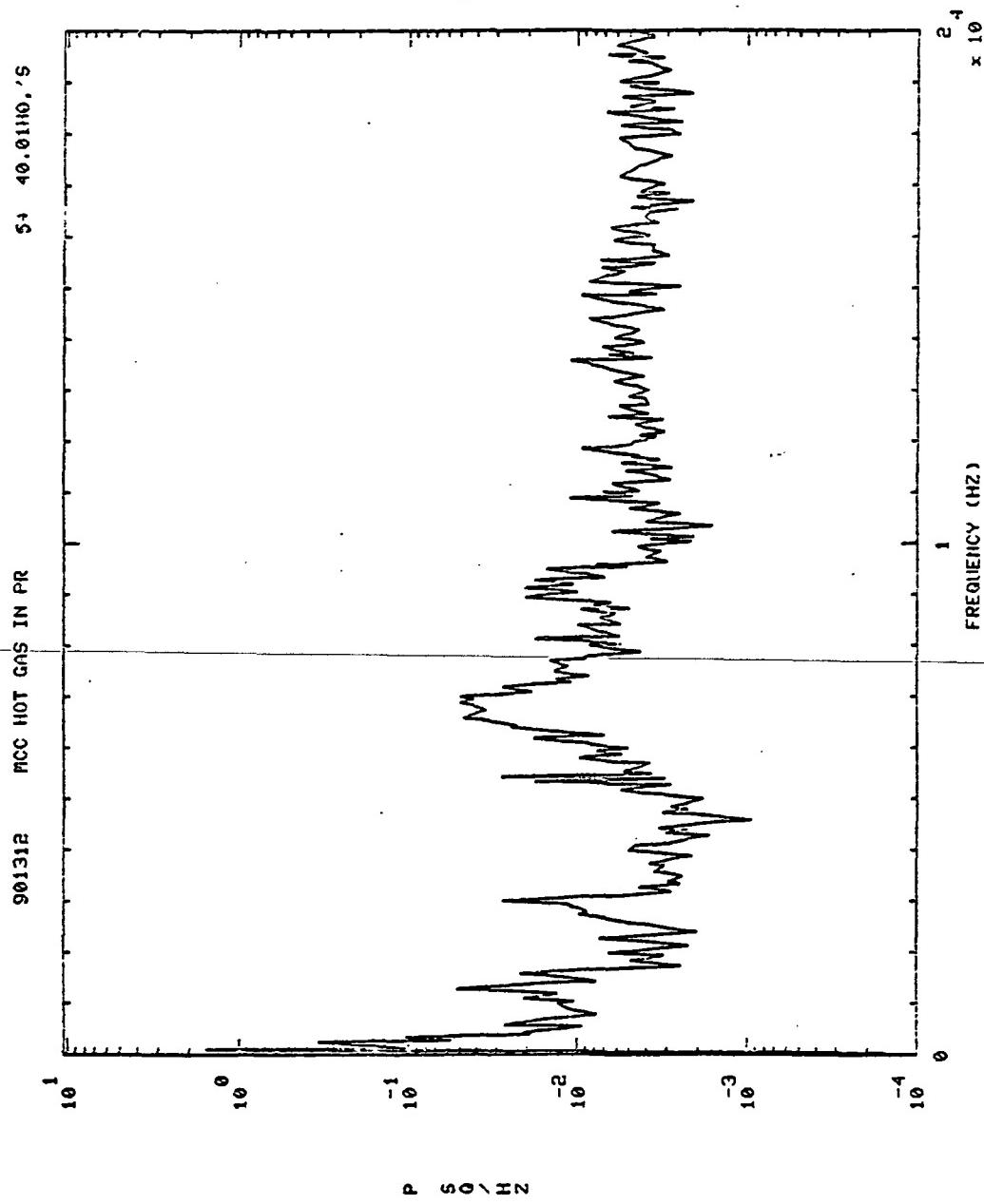
S+ 6.01H0, S

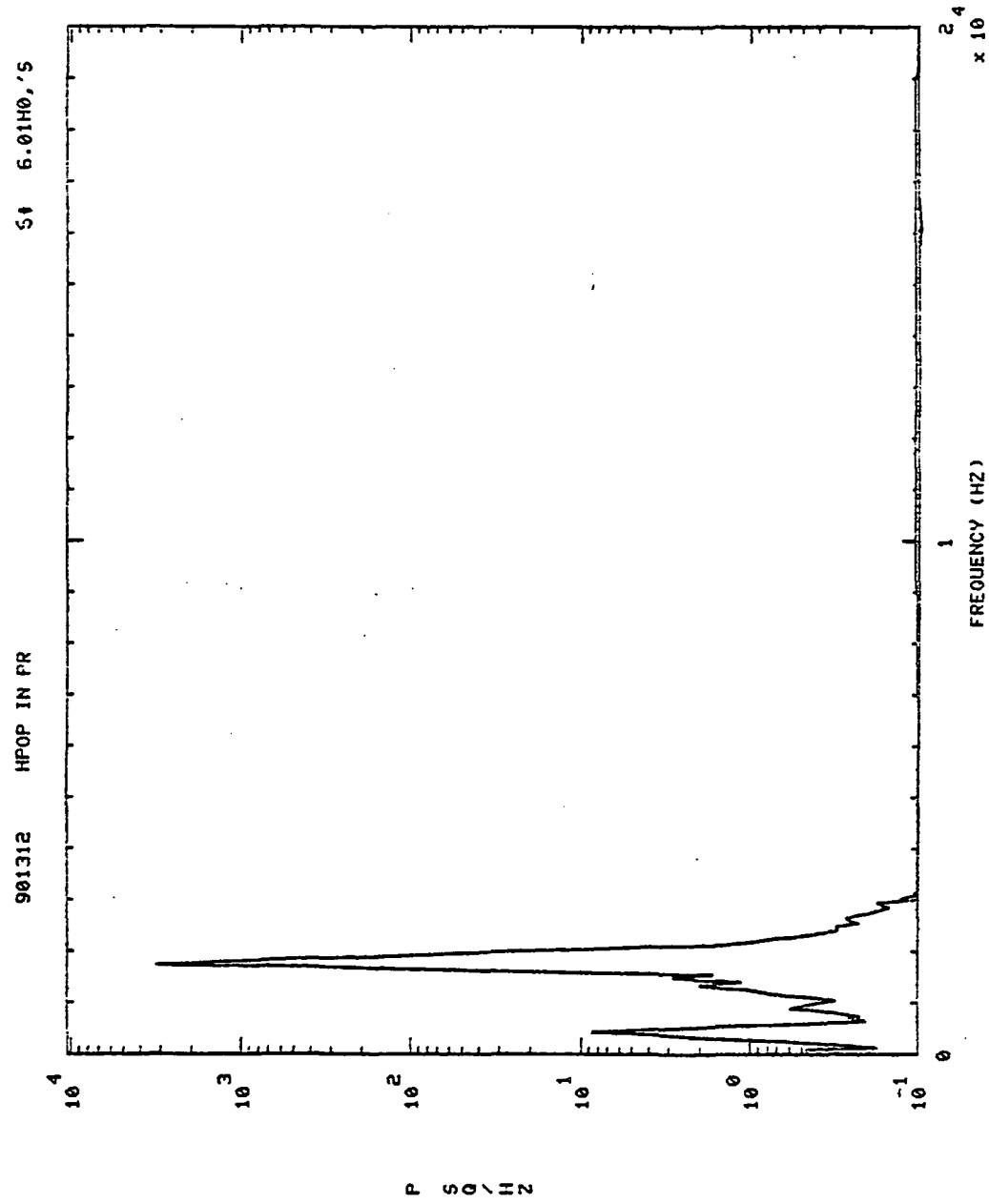
PSD / Hz

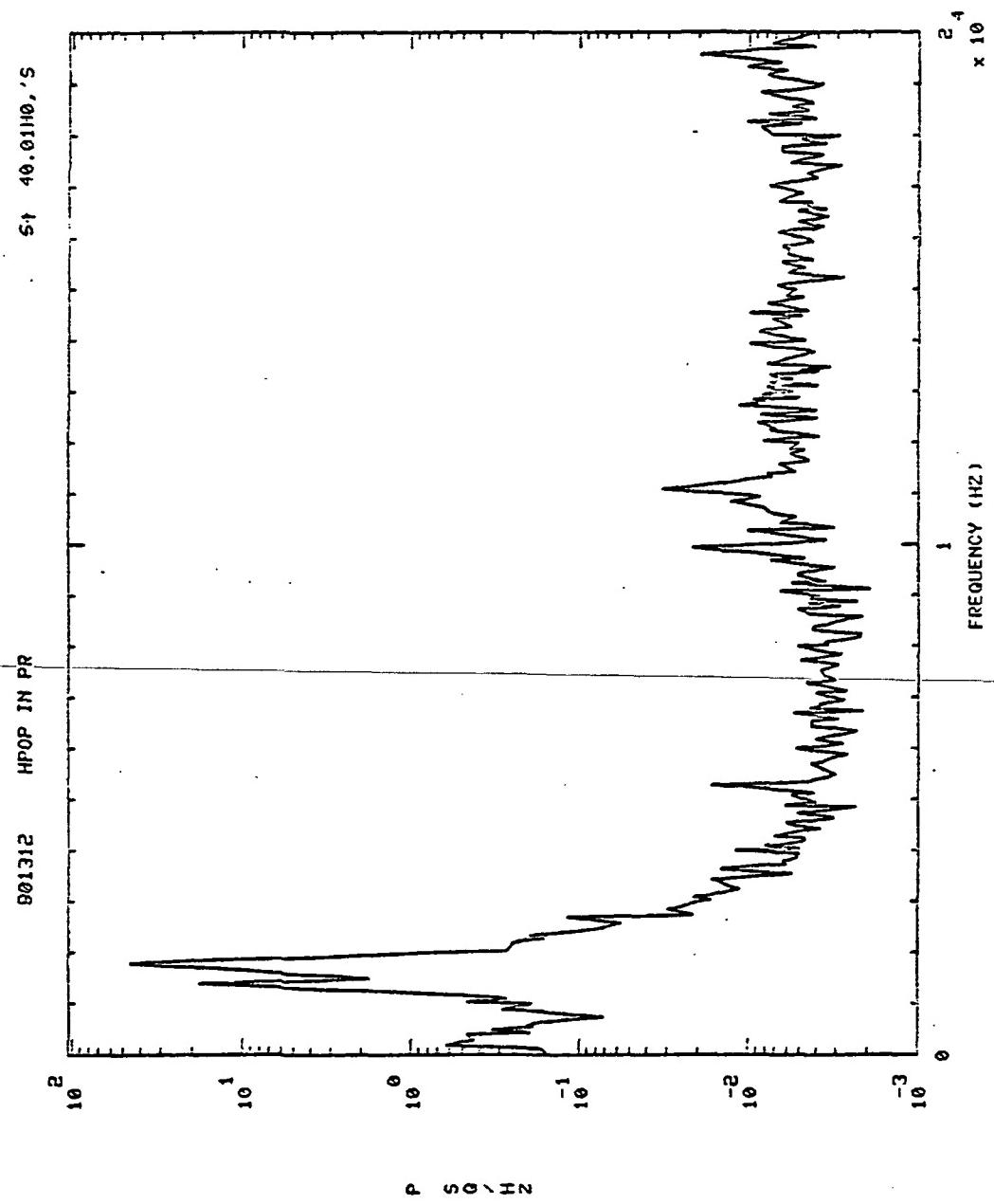
FREQUENCY (Hz)

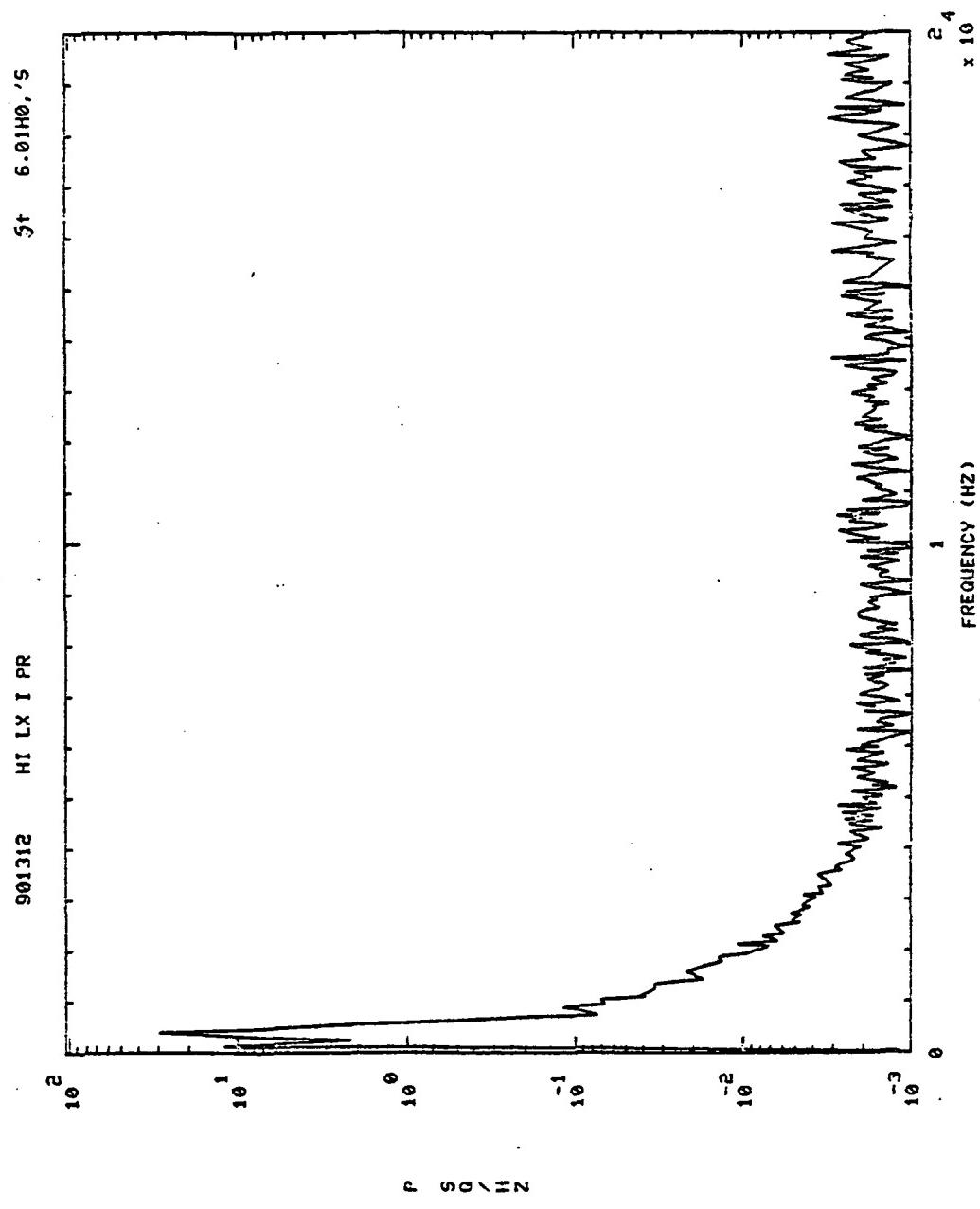
2 4
x 10

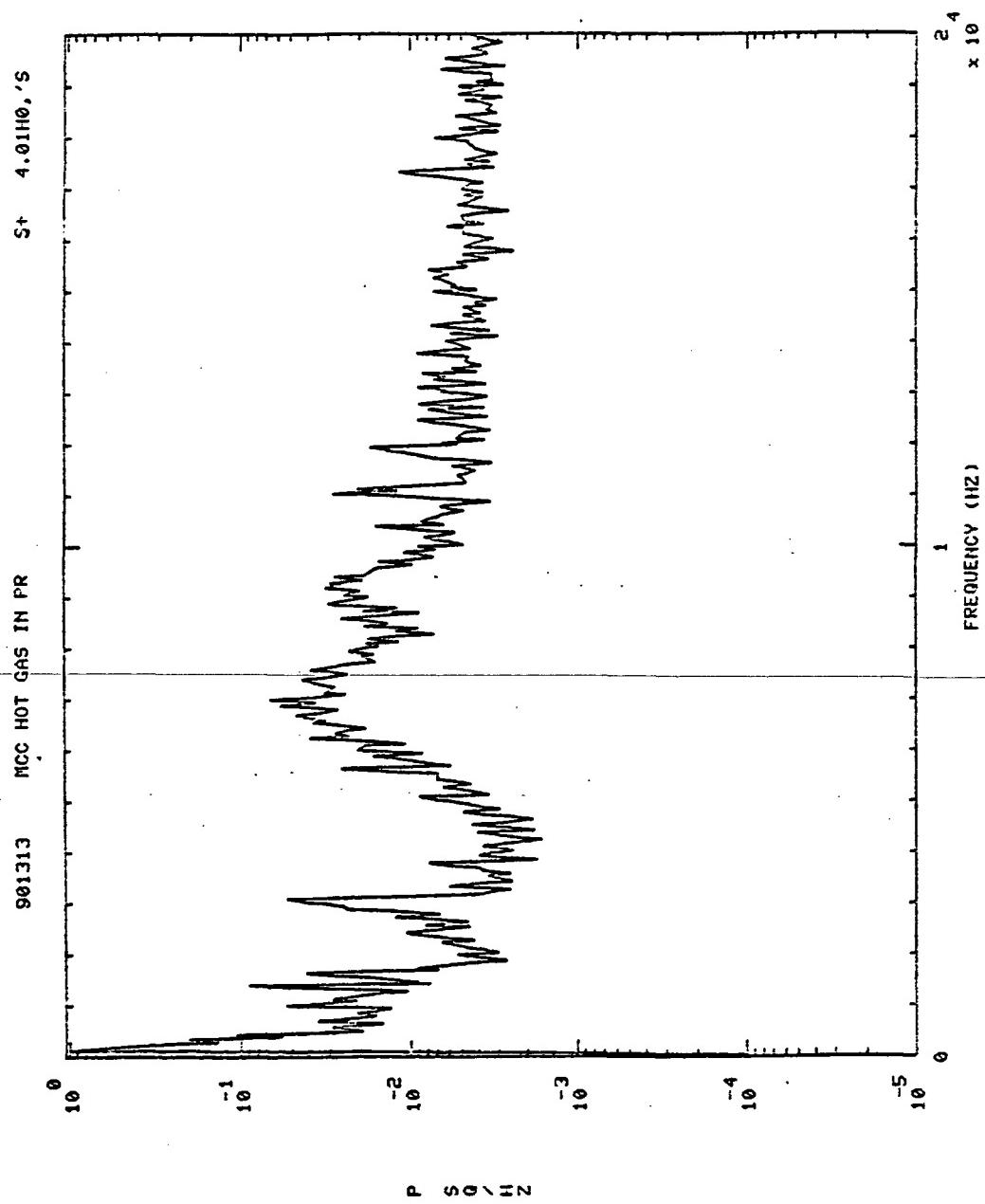




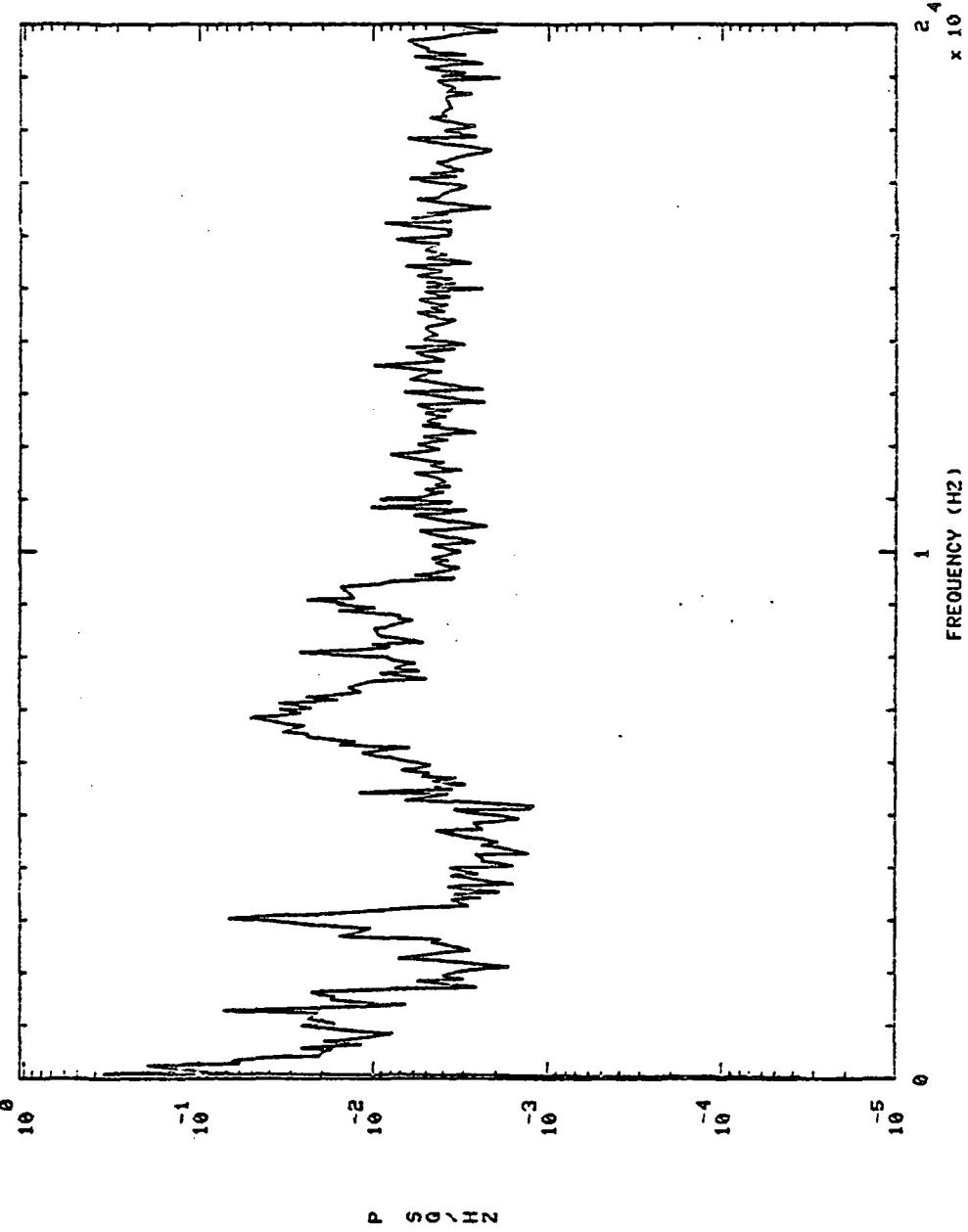


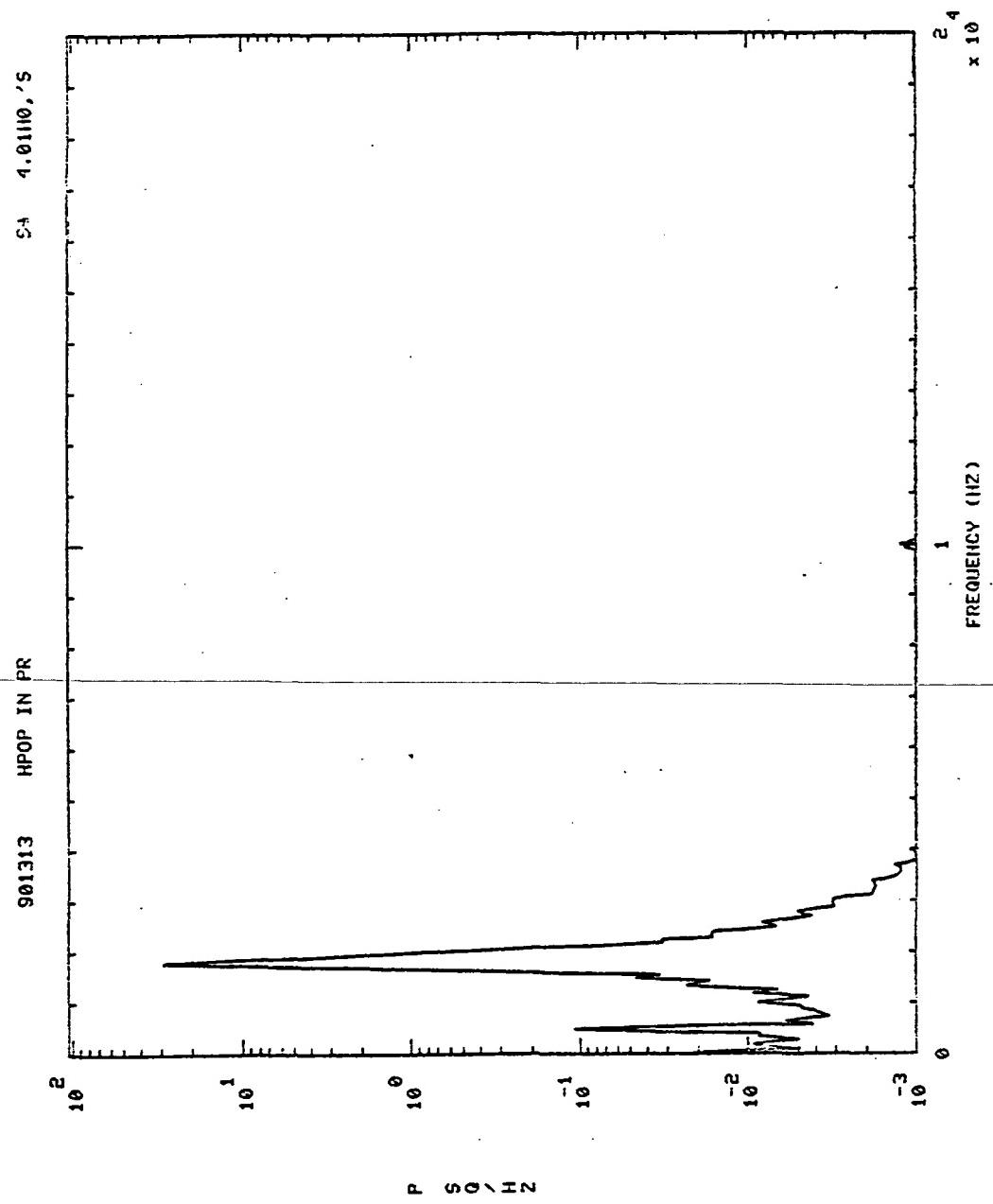






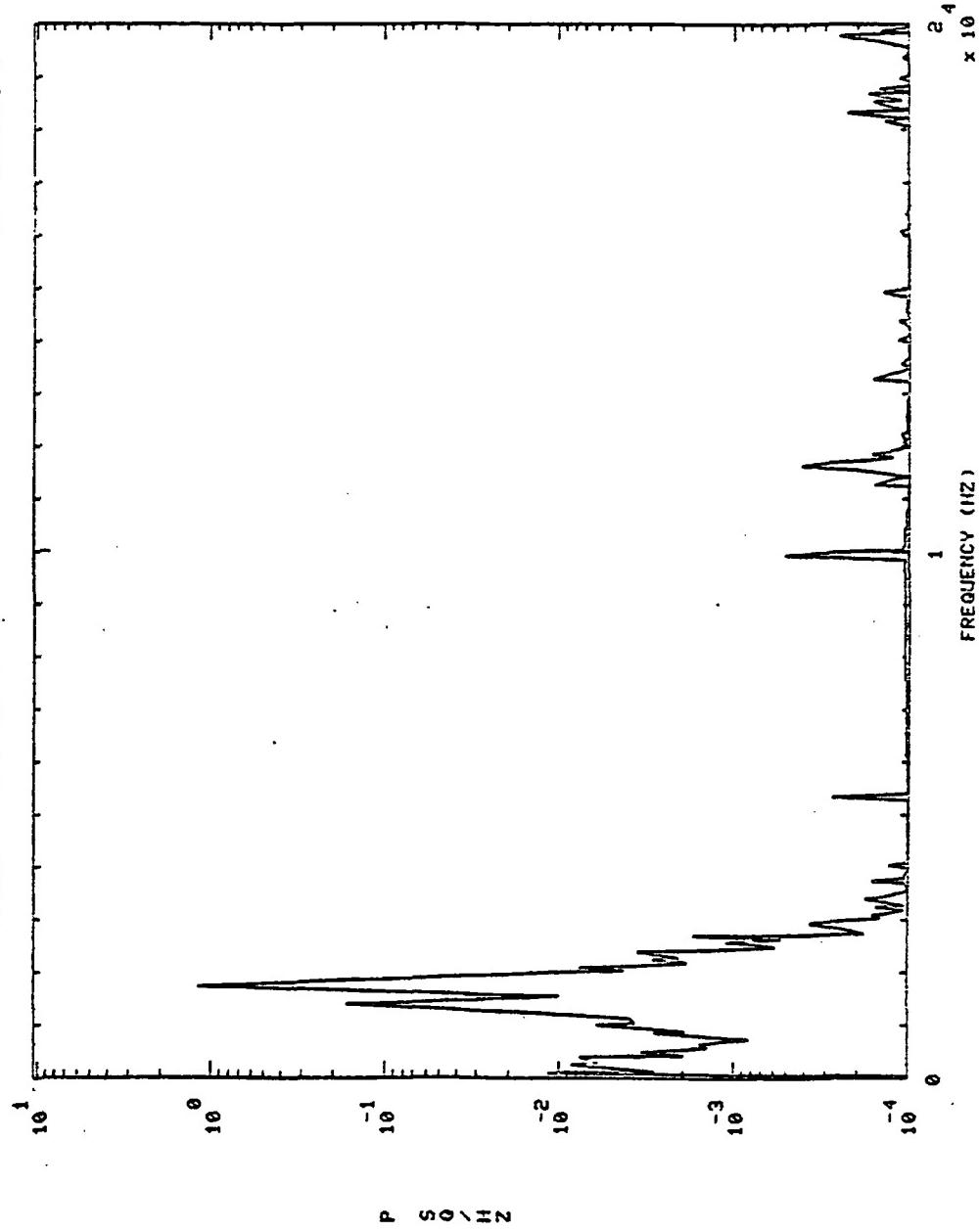
901313 MCC HOT GAS IN PR S+ 30.01100, 'S

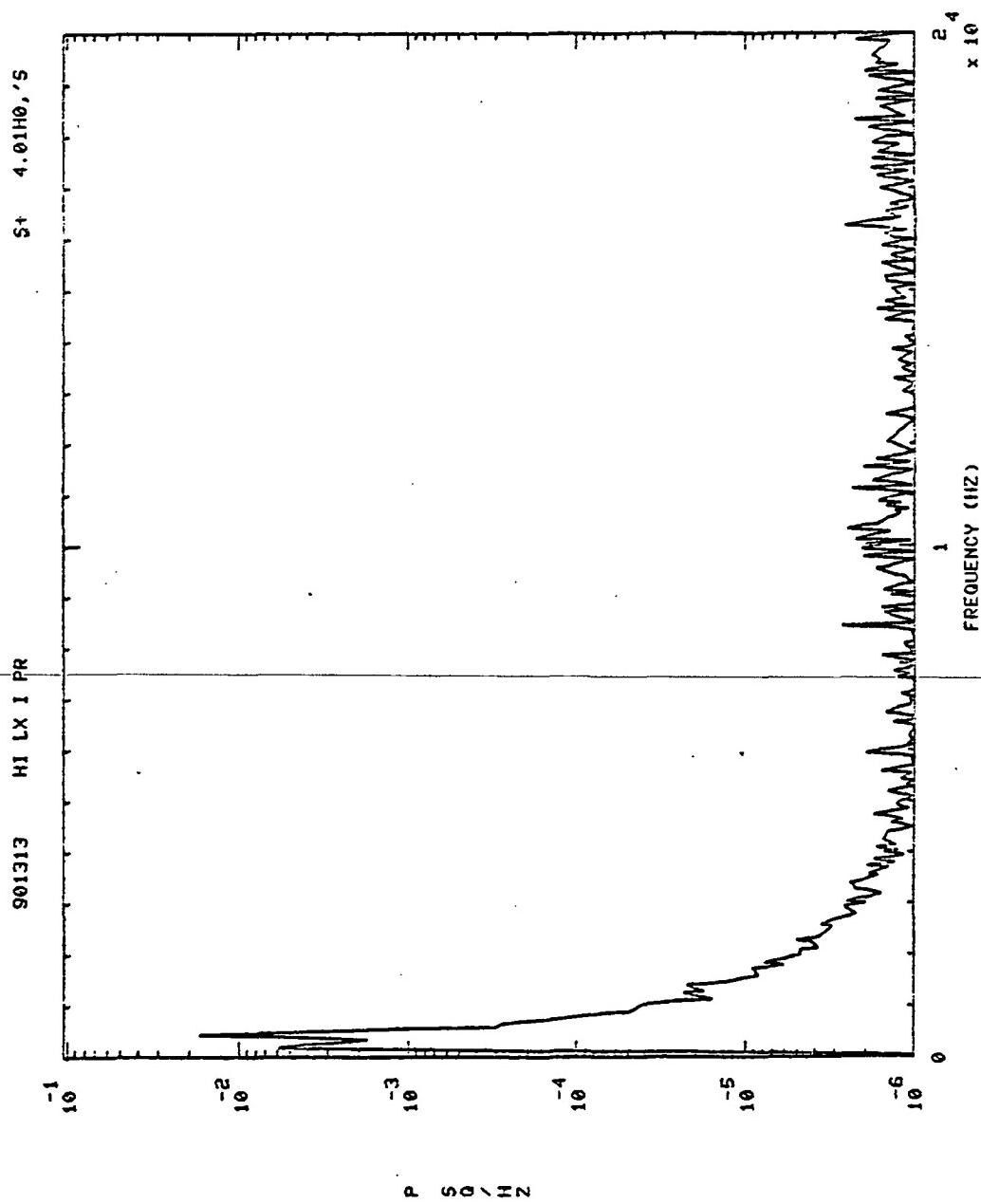




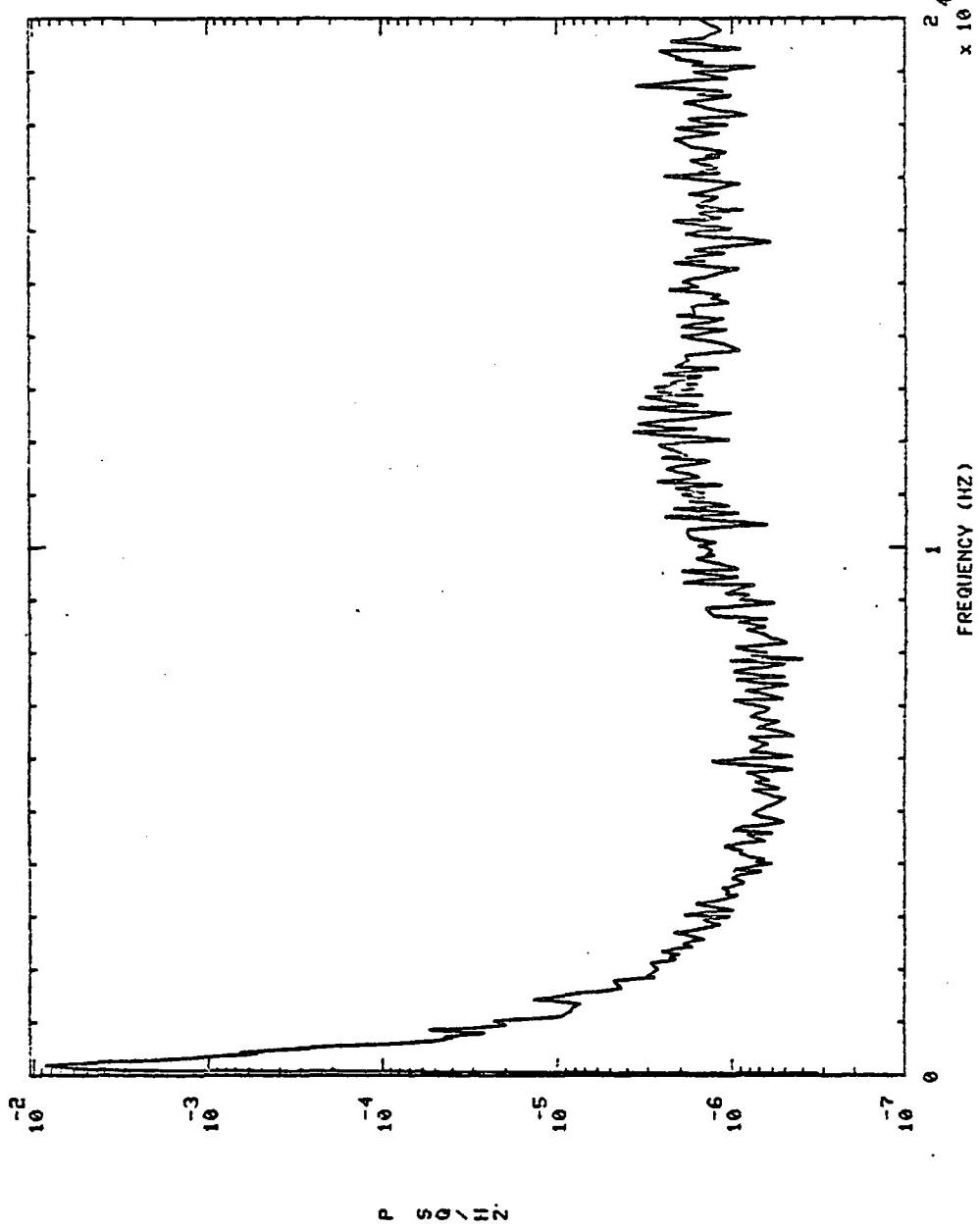
901313 HPOP IN PR

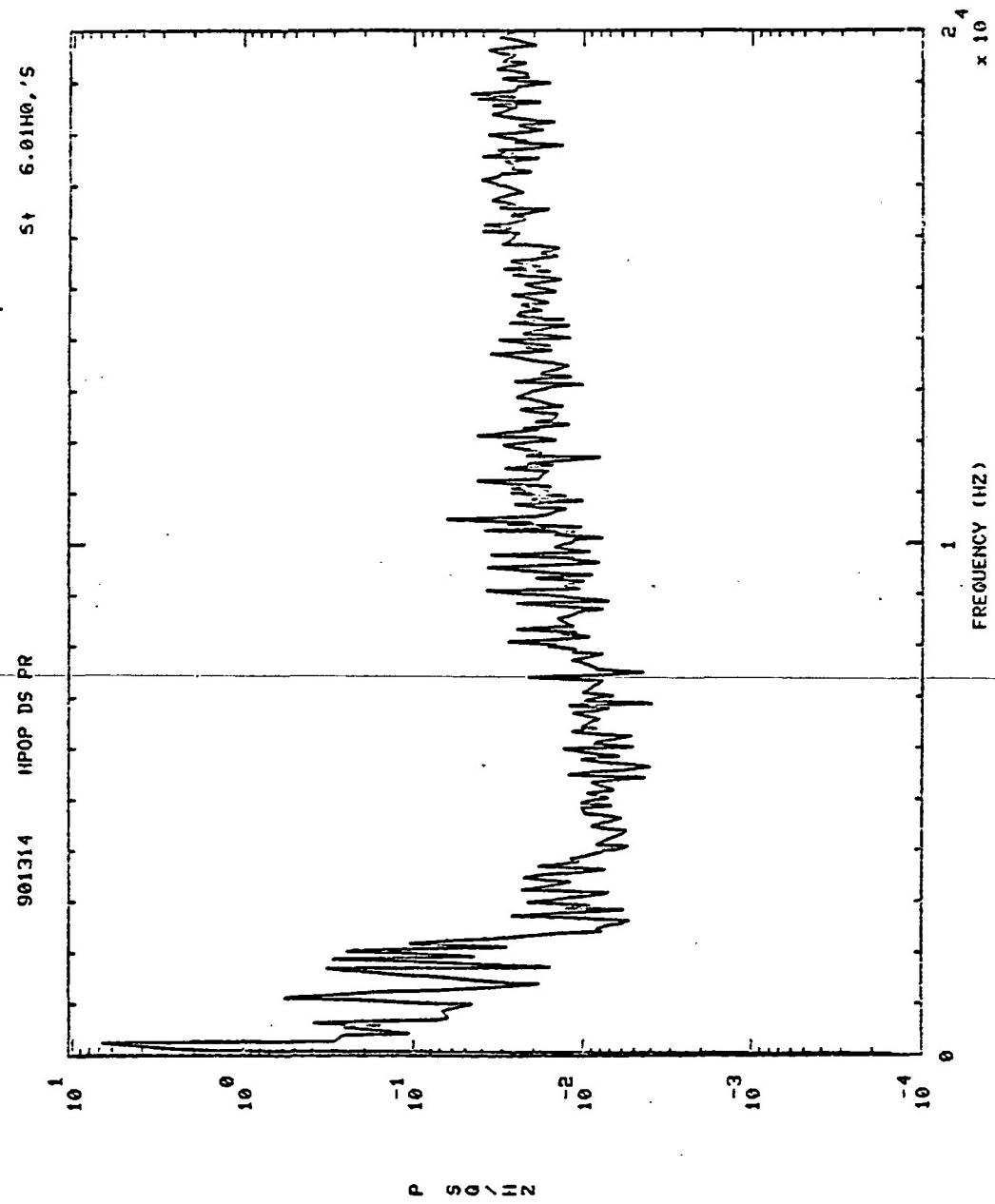
S+ 30.0140, '5





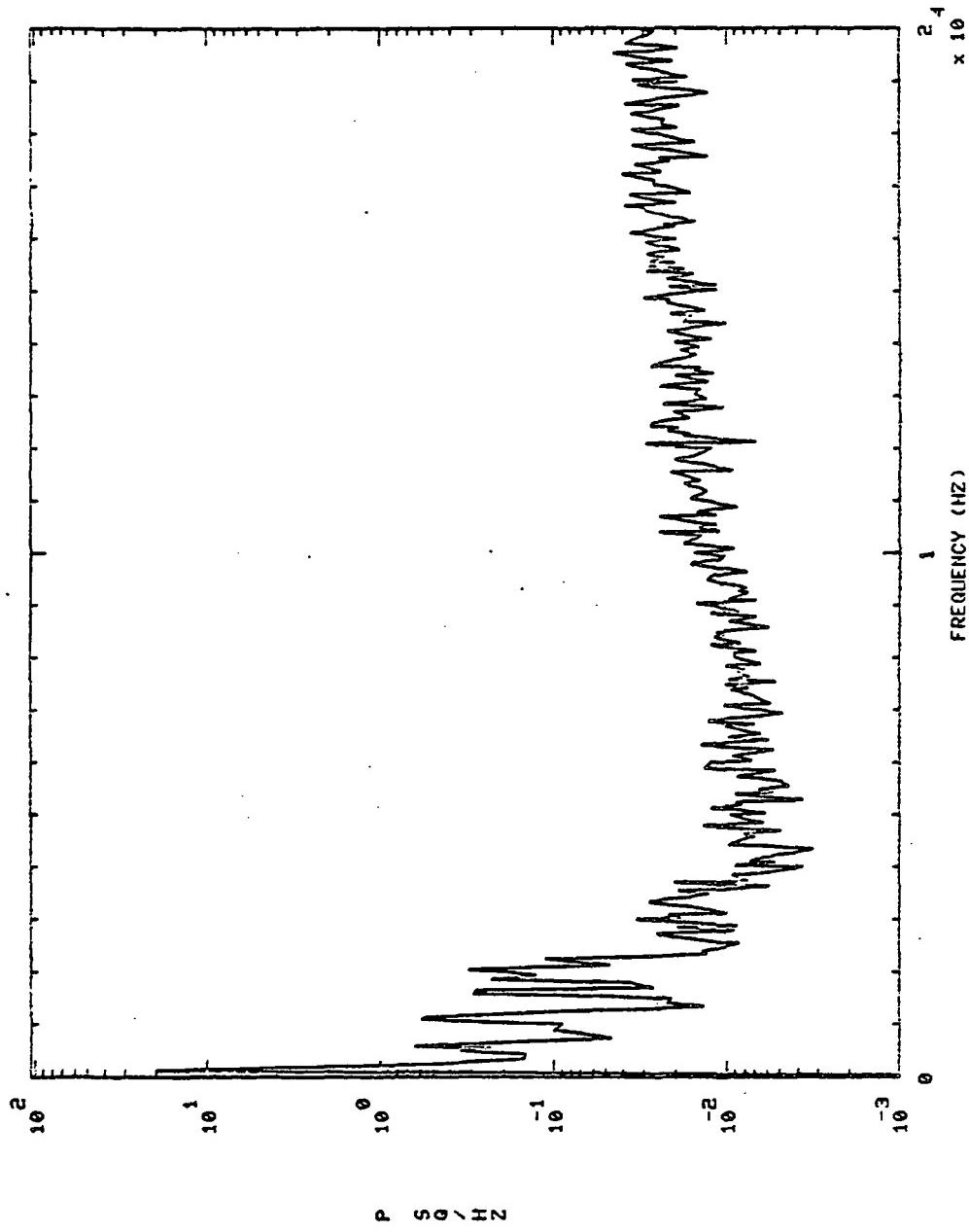
901313 HI LX I PR S+ 30.01H0.,'

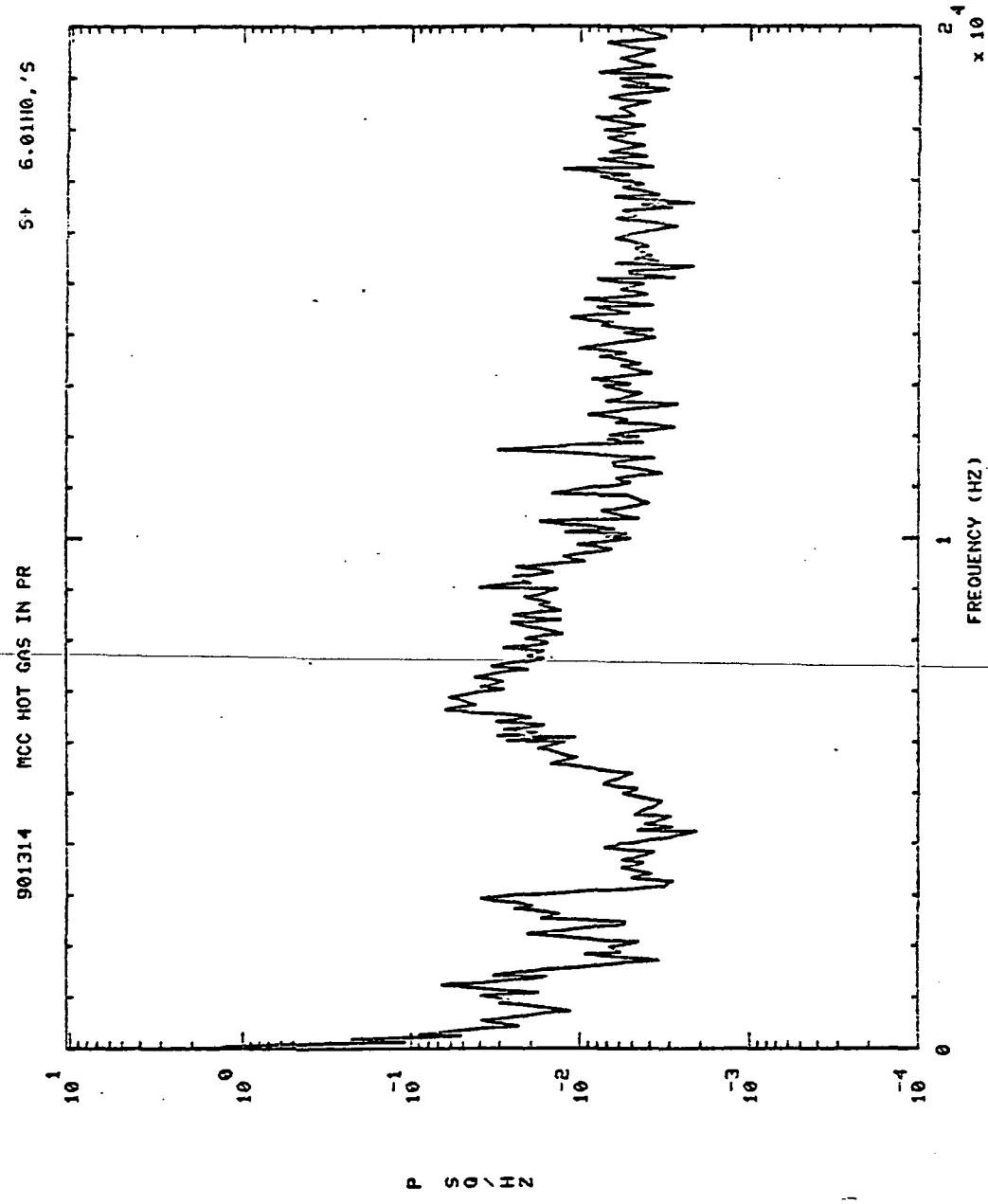


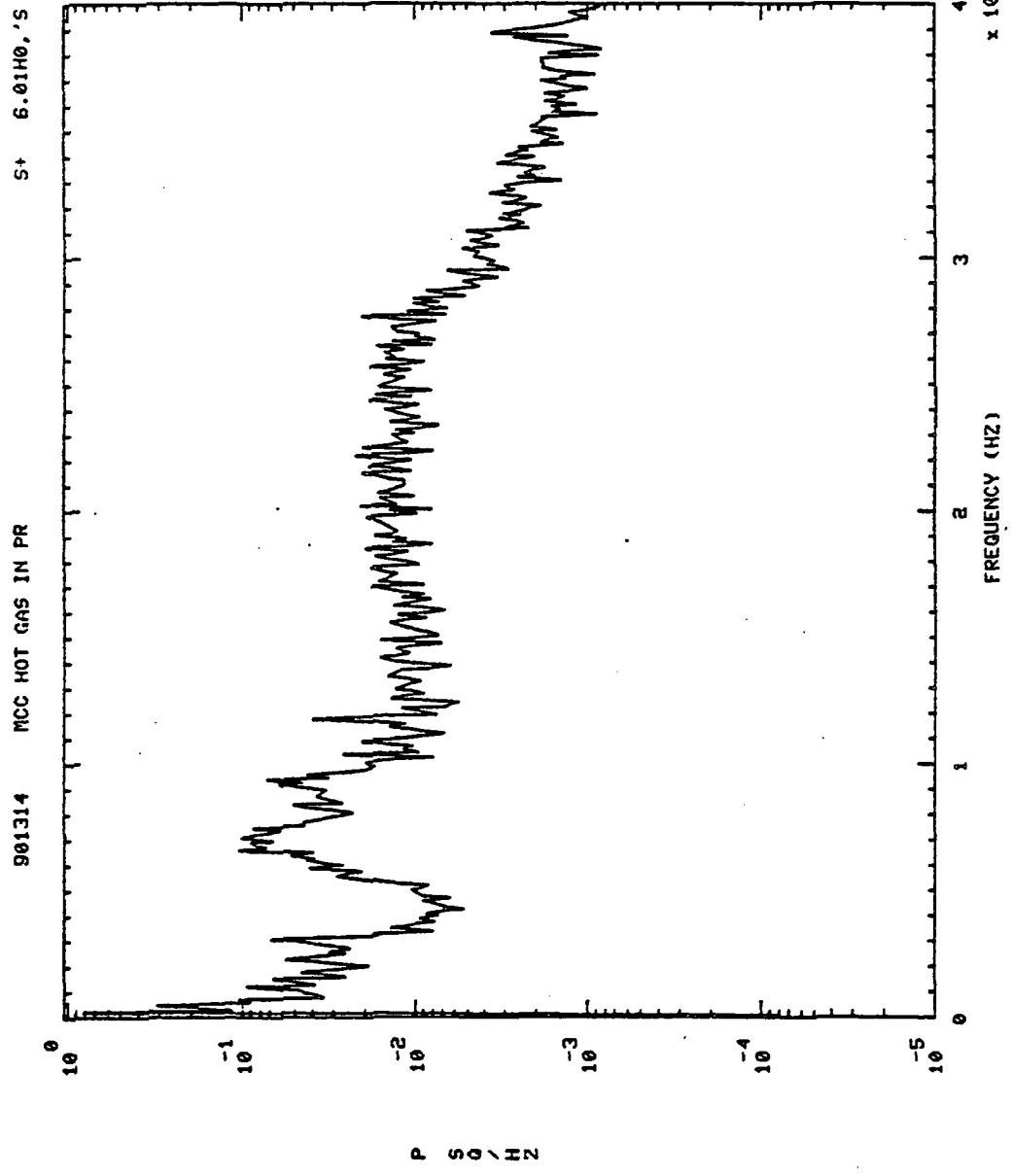


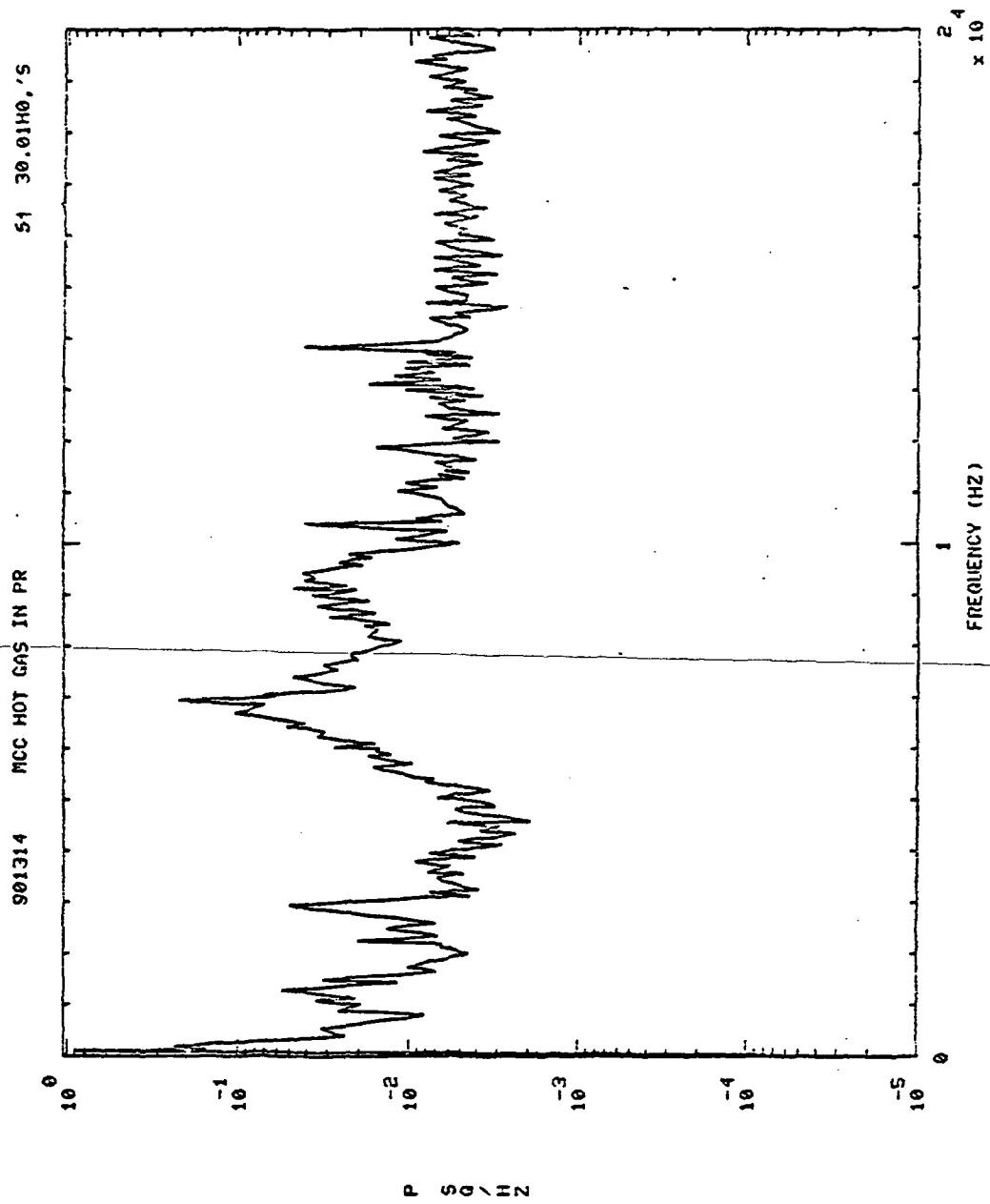
901314 HPOP DS PR

SF 30.01Hz, s



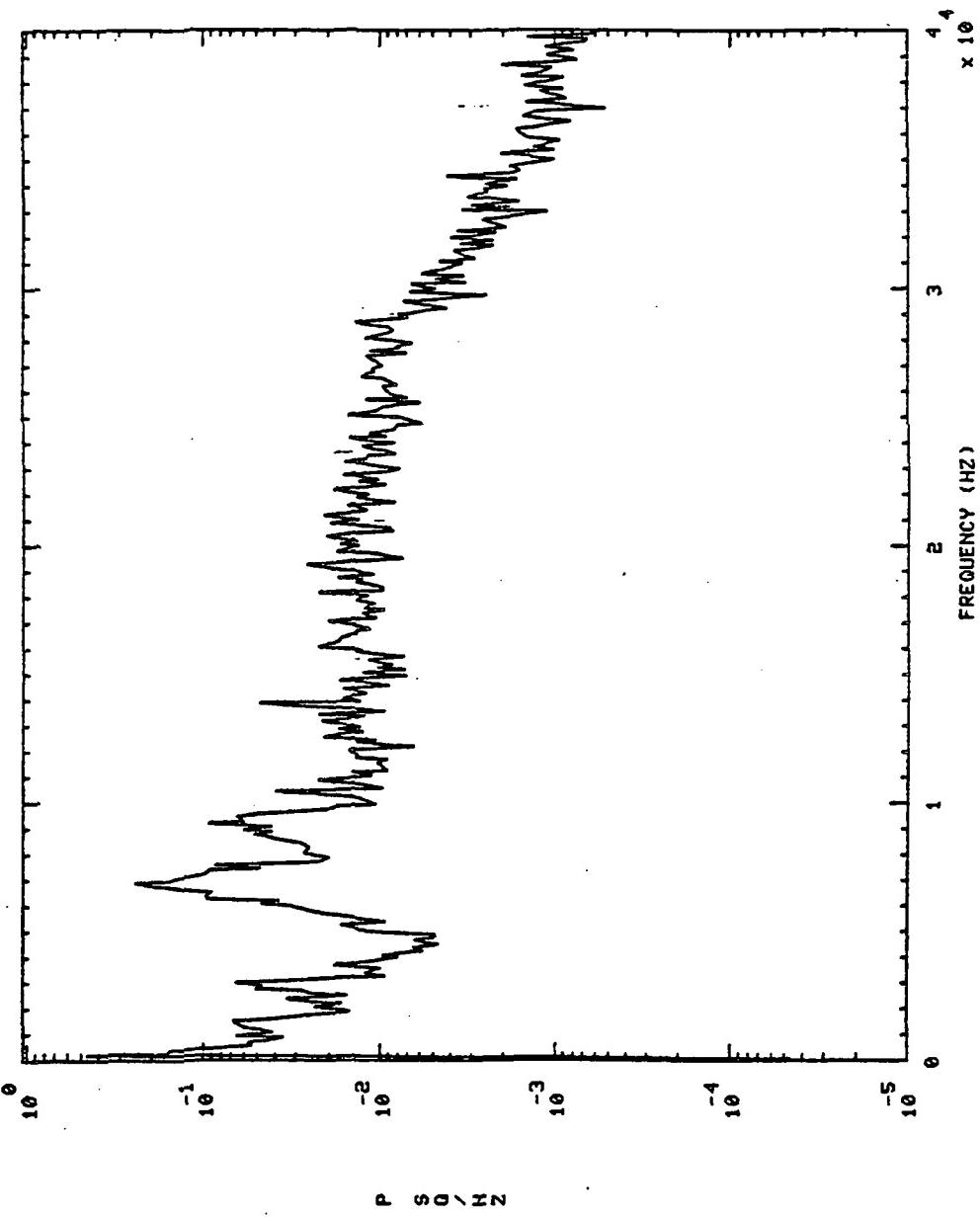


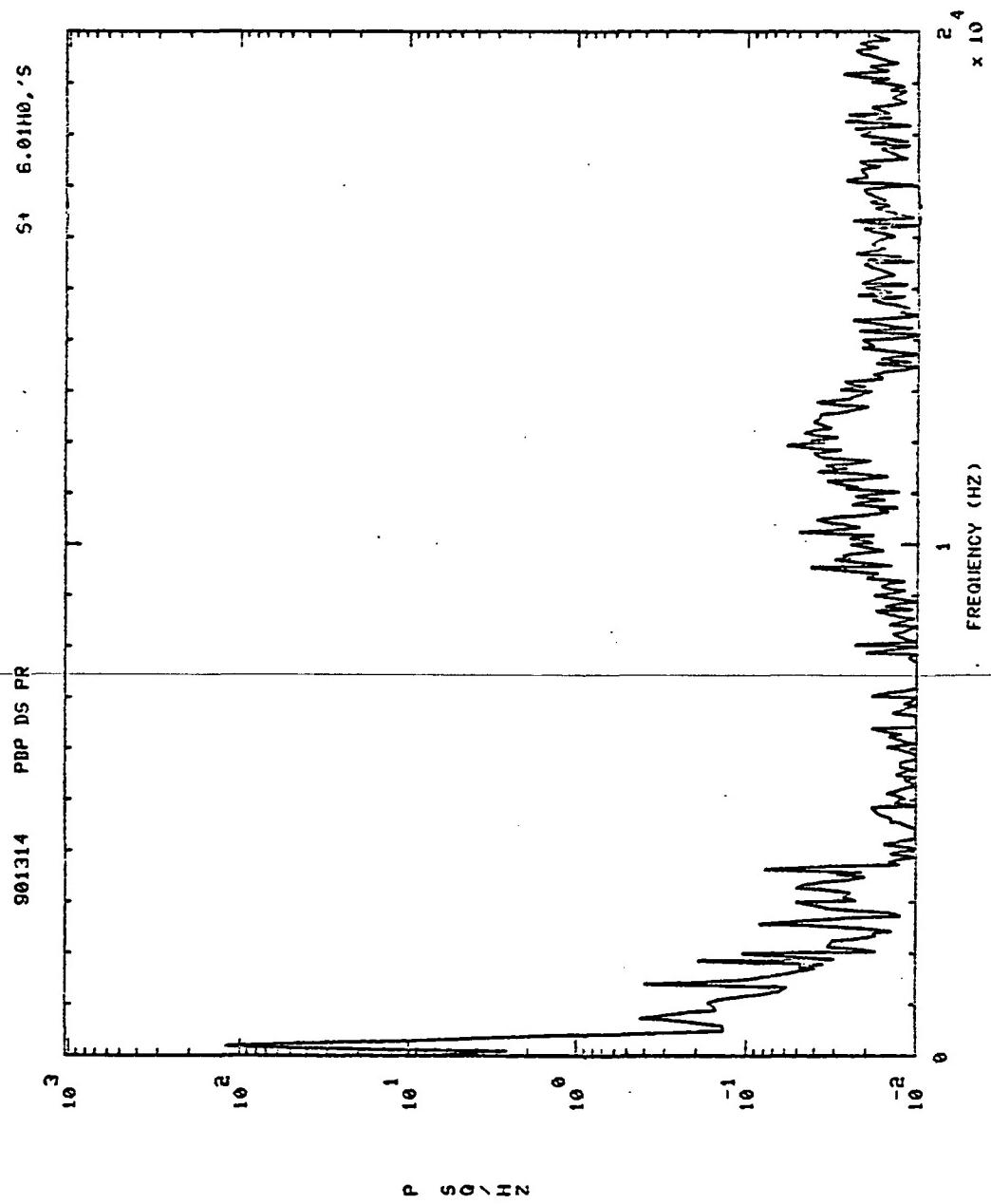




901314 MCC HOT GAS IN PR

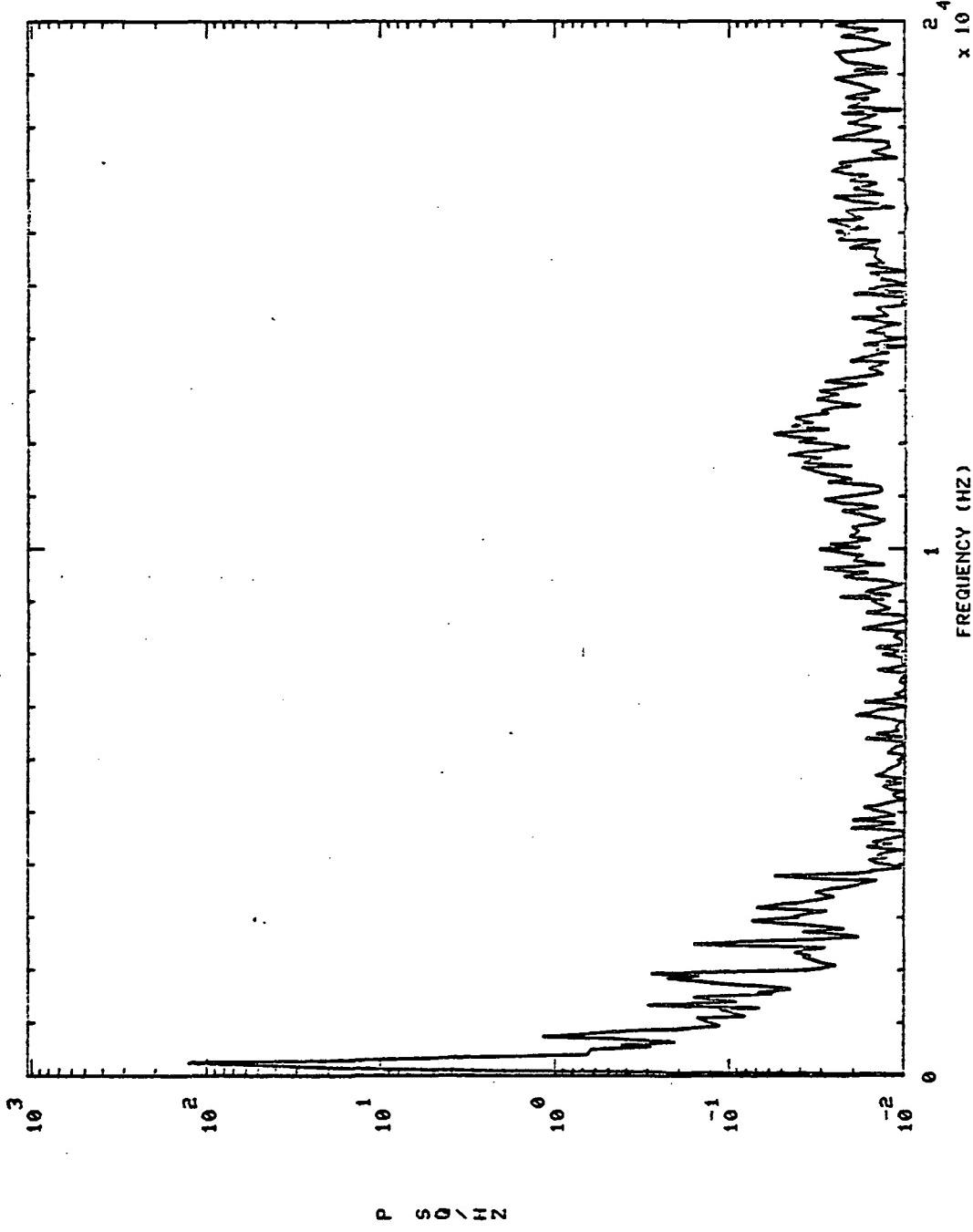
S+ 30.01H0.'S

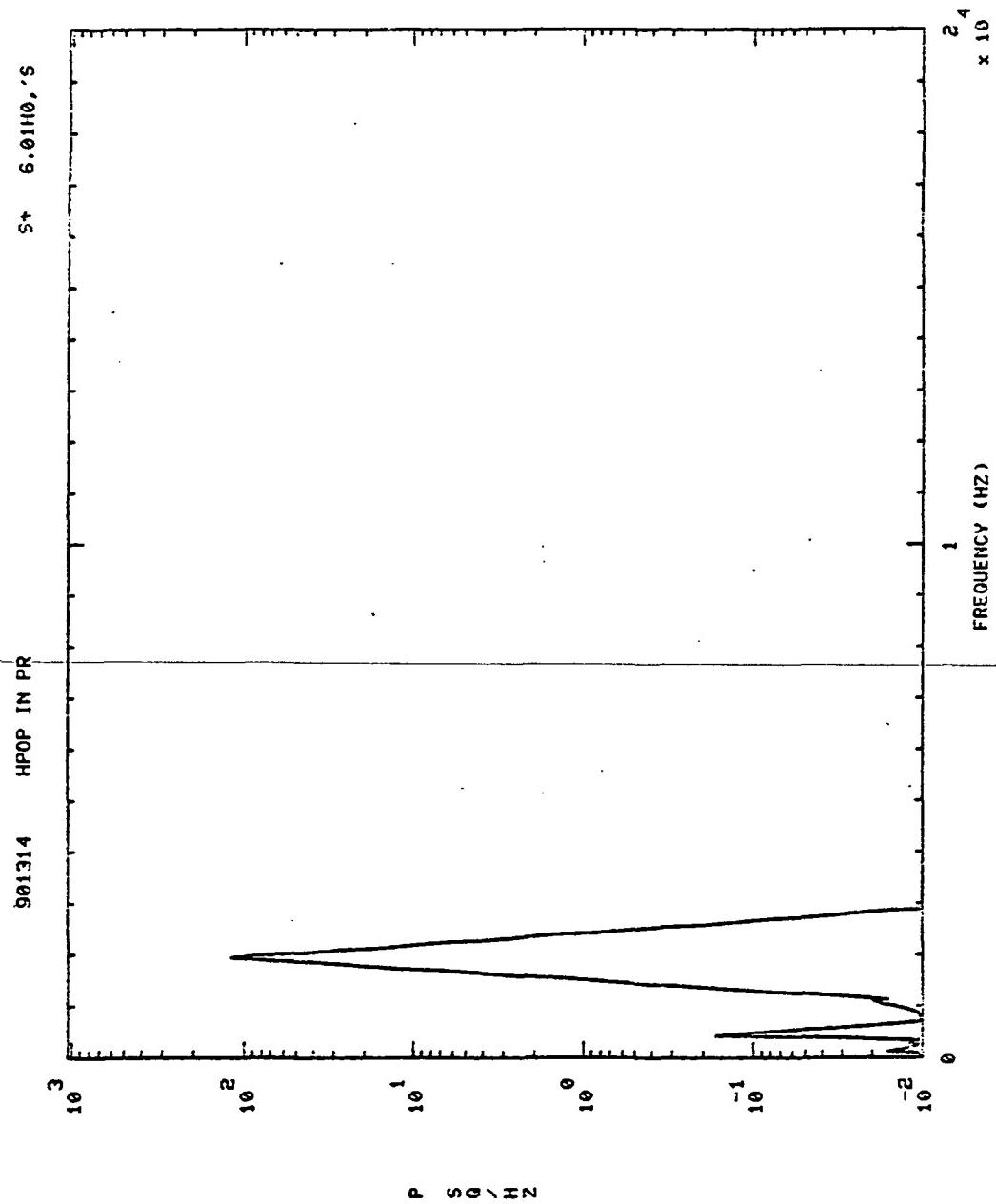




901314 PBP DS PR

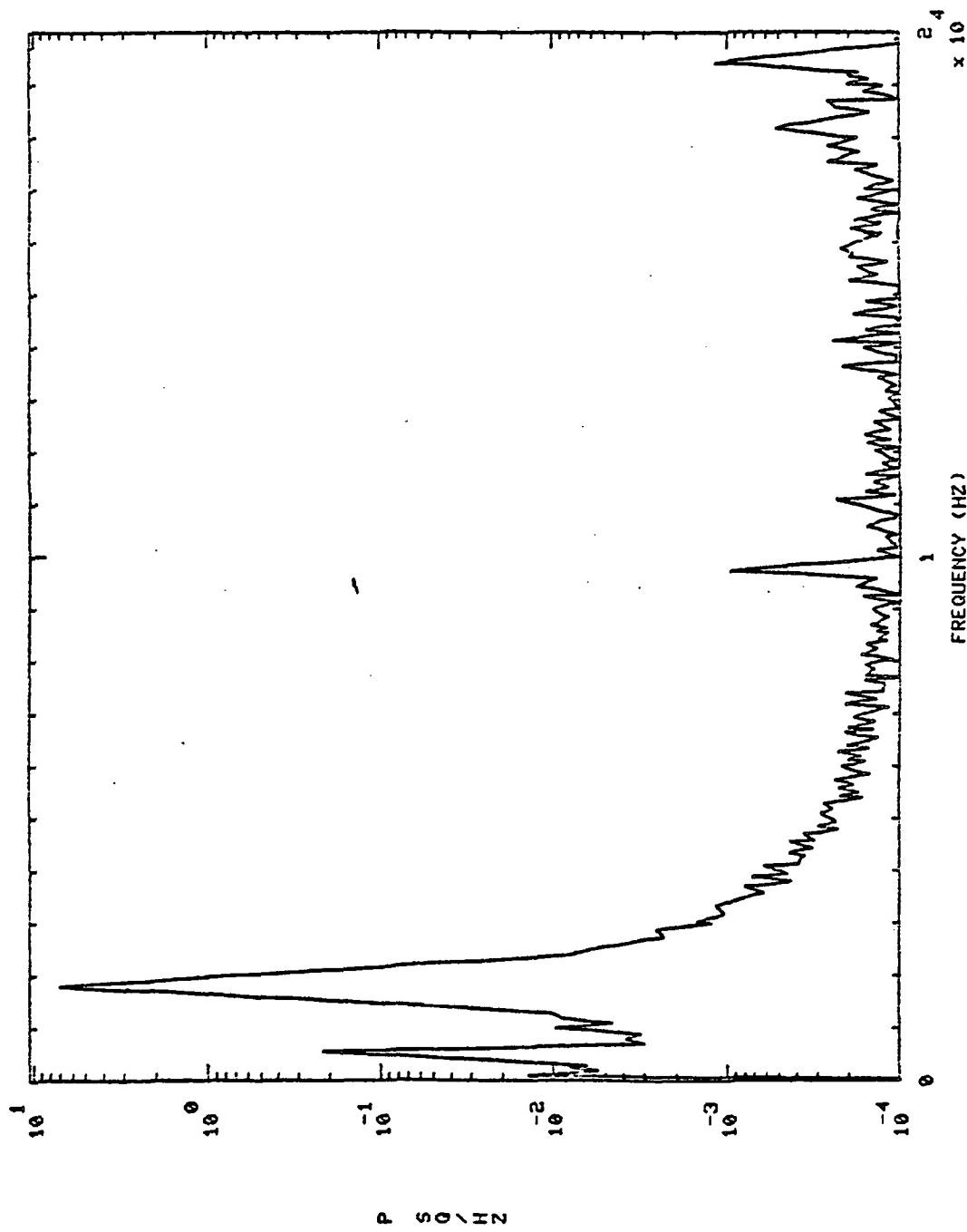
S+ 30.0110.15

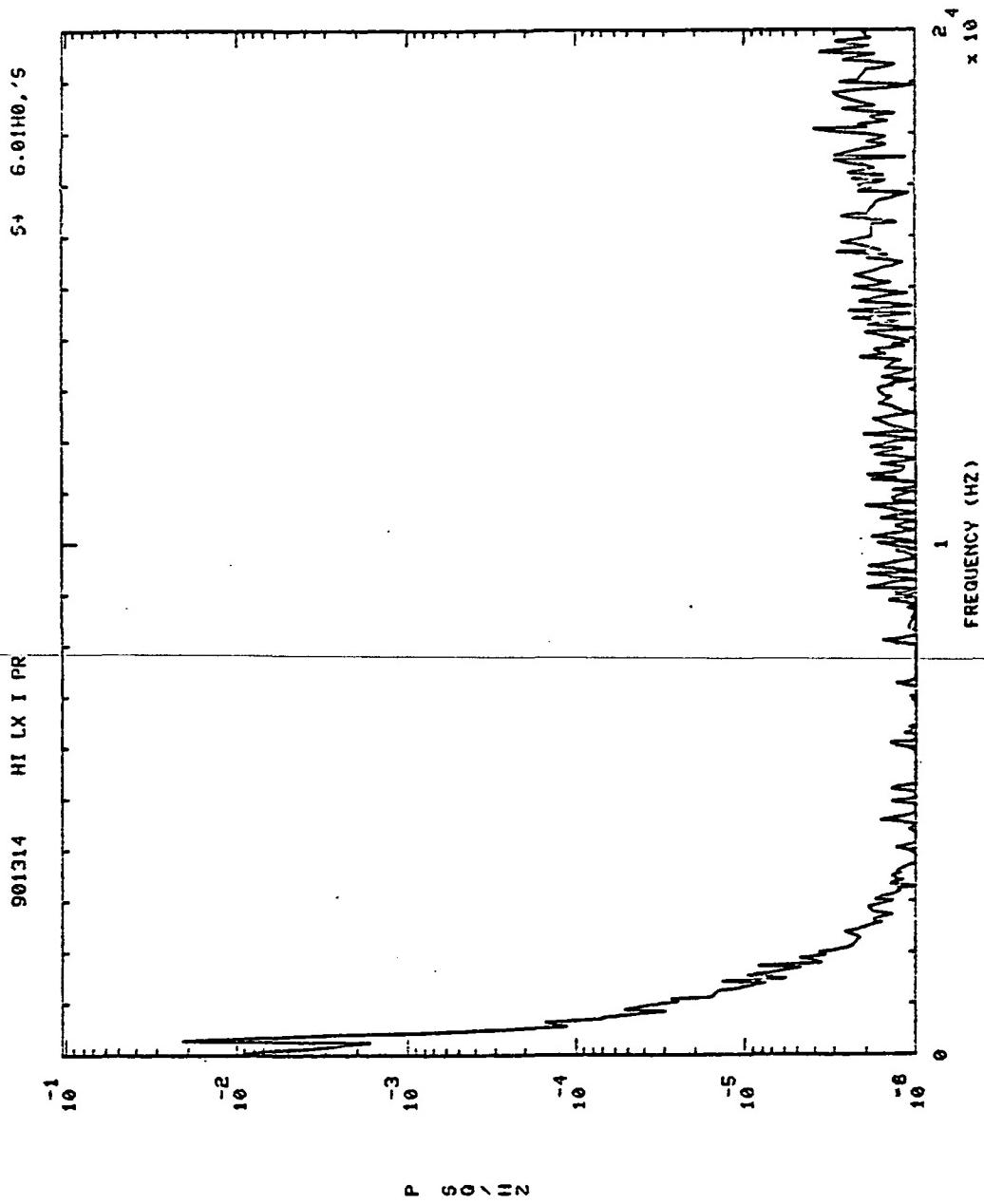




S+ 30.01110.'S

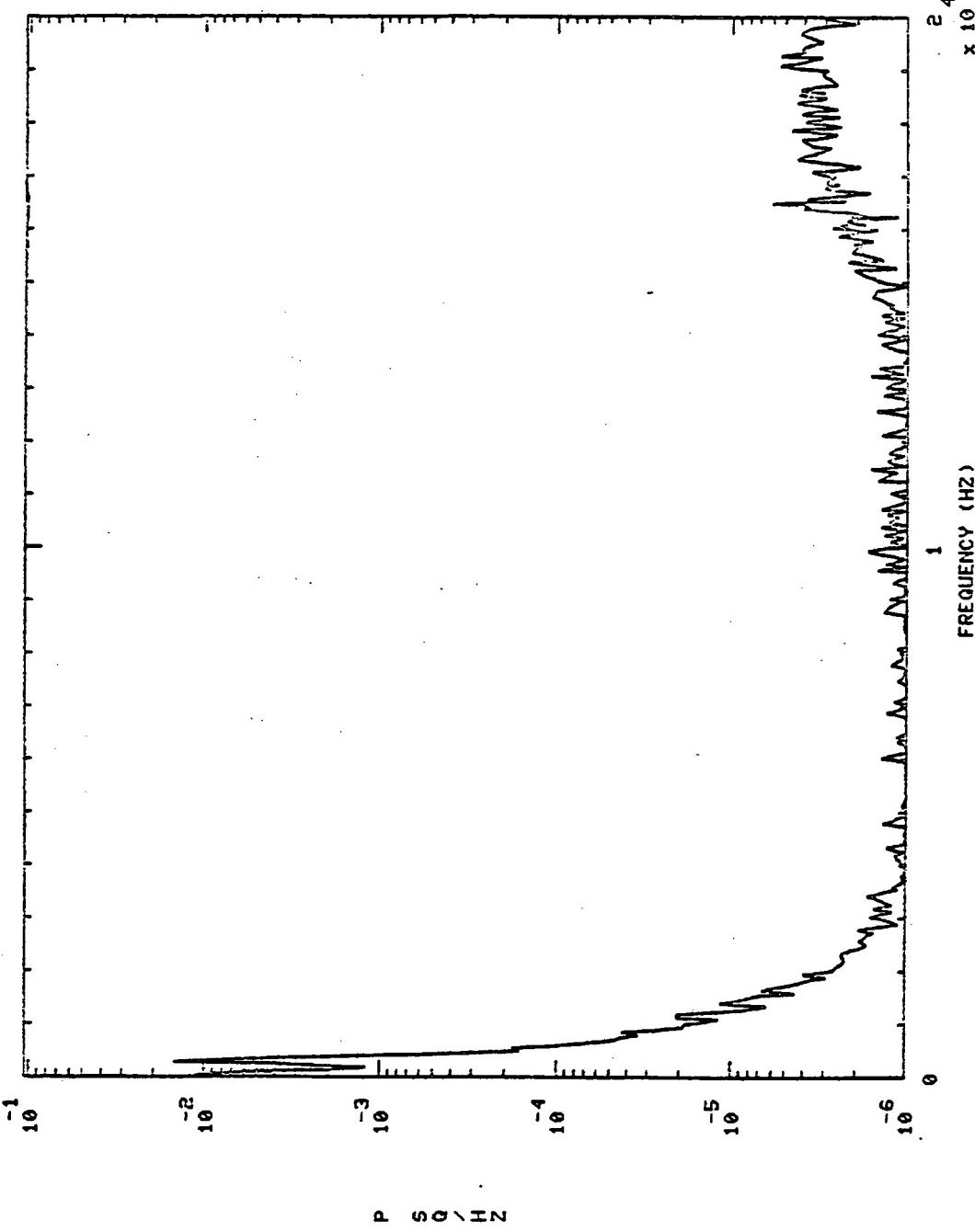
901314 HPOP IN PR

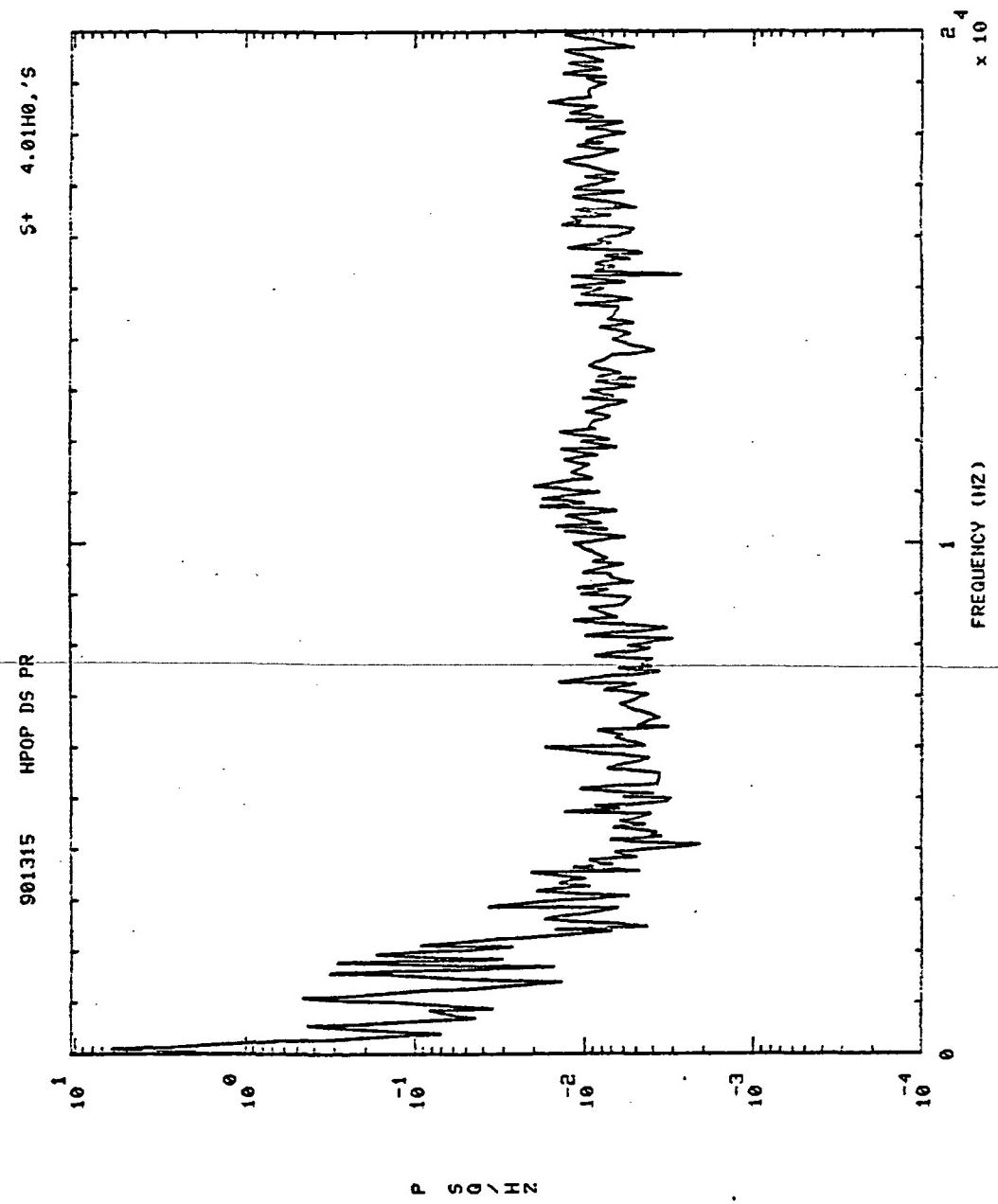




901314 HI LX I PR

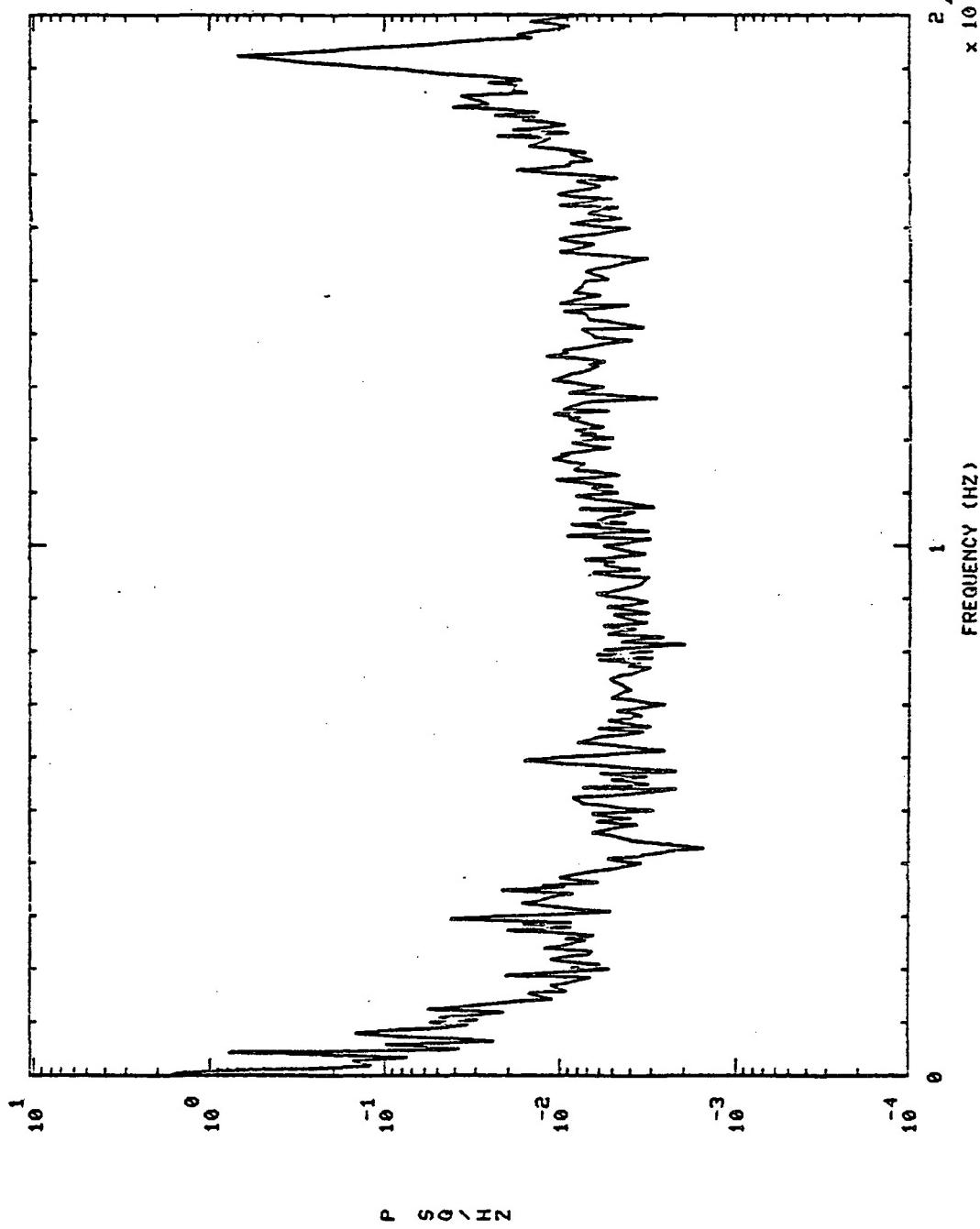
S+ 30.01H0.'S



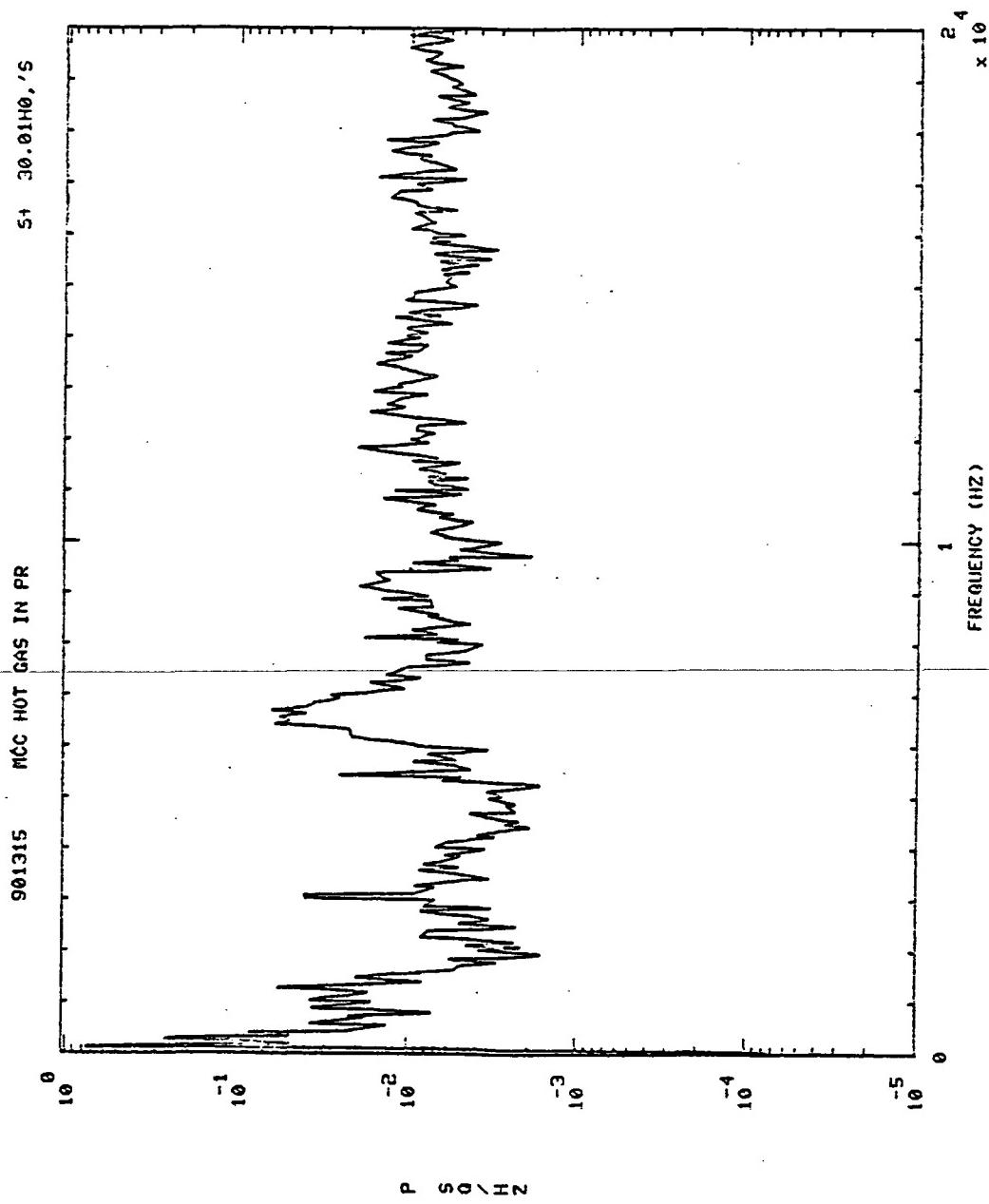


St 30.01H0, 'S

HPOP DS PR
901315

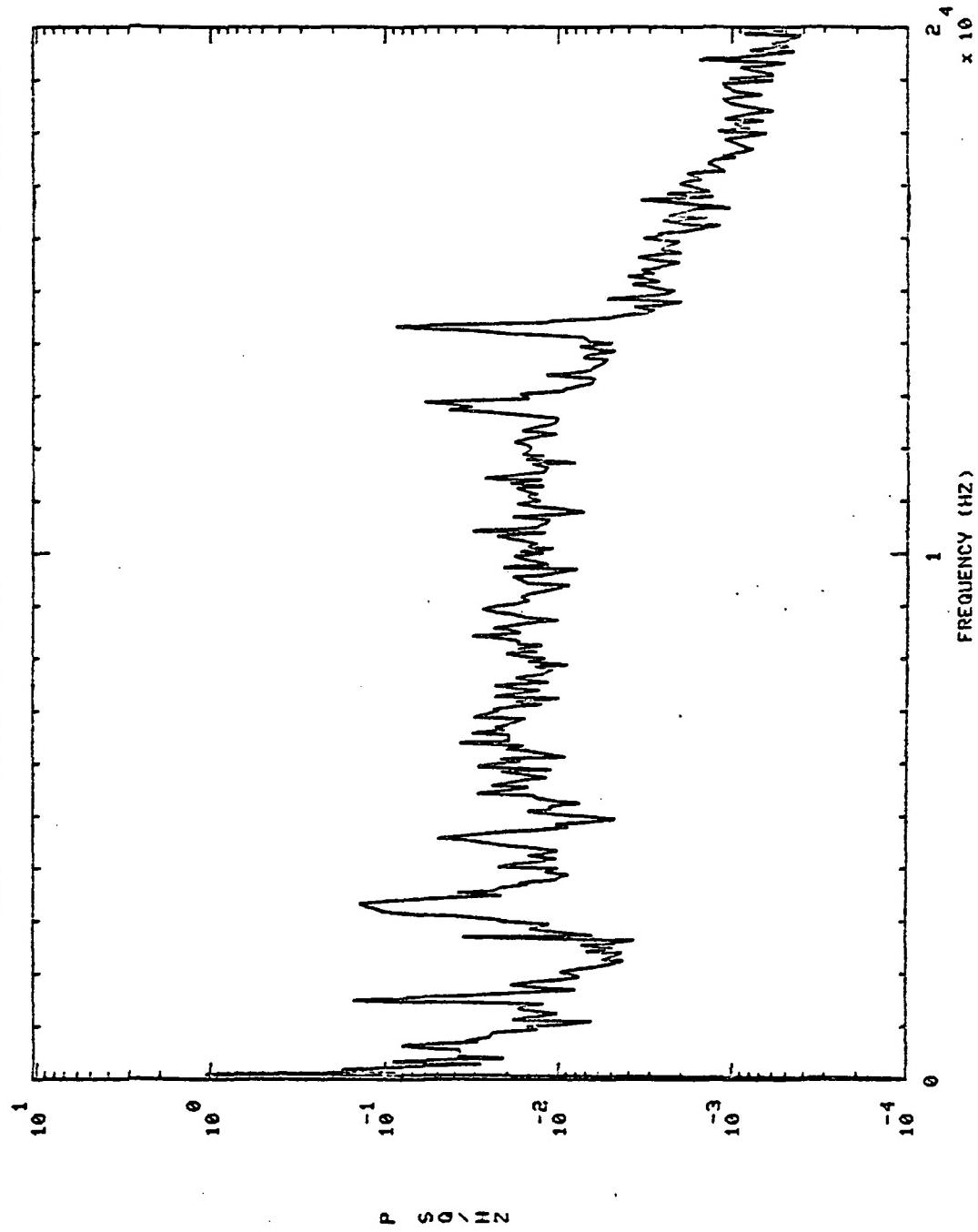


P S Q / Hz

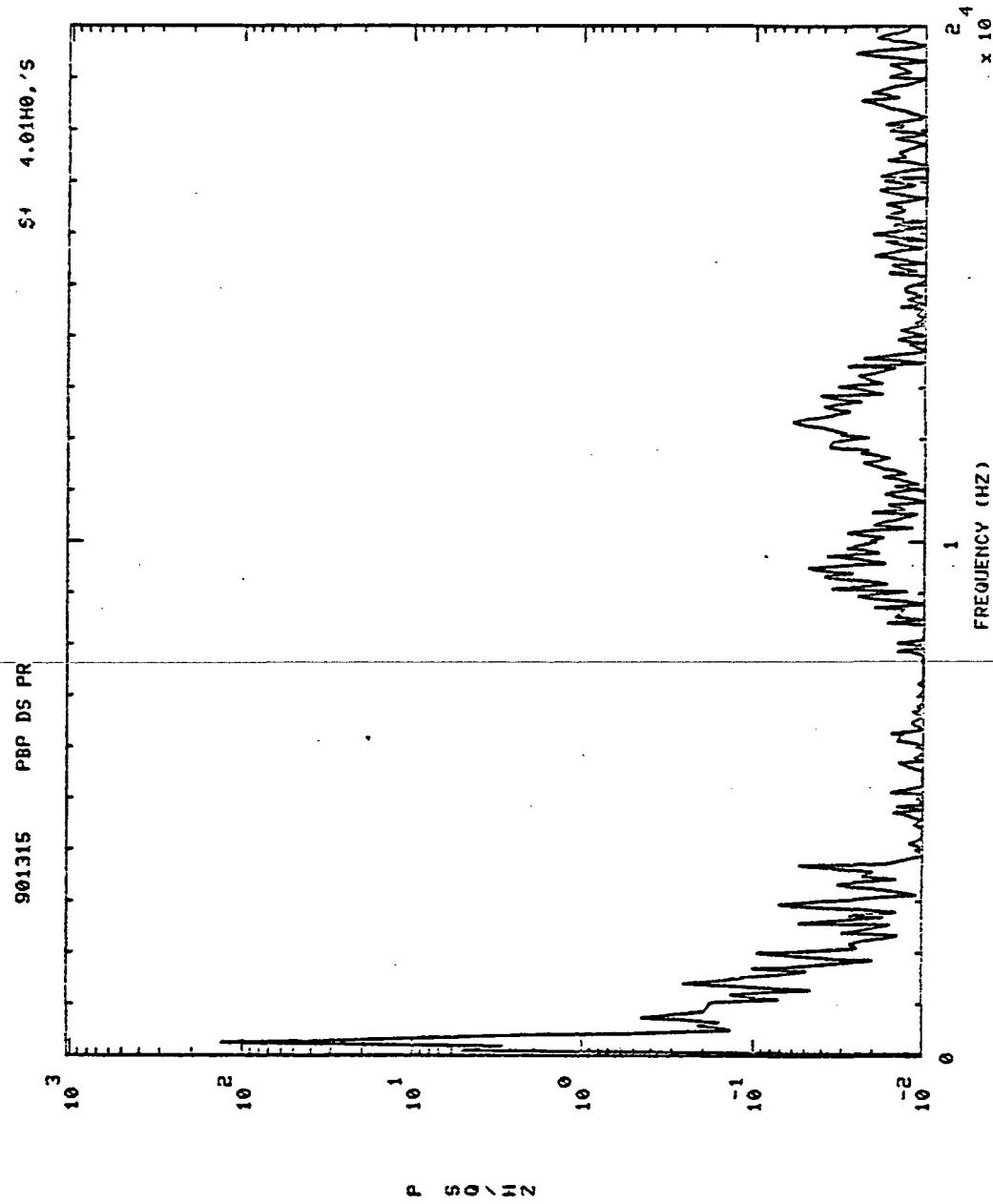


901315 MCC HOT GAS IN PR

Sr 60.01H0, 'S



P
S
C / HZ



1

0

-1

-2

-3

-4

-5

-6

-7

-8

-9

-10

-11

-12

-13

-14

S+

PBP

DS

PR

901315

0

1

2

3

4

5

6

7

8

10⁰

10⁻¹

10⁻²

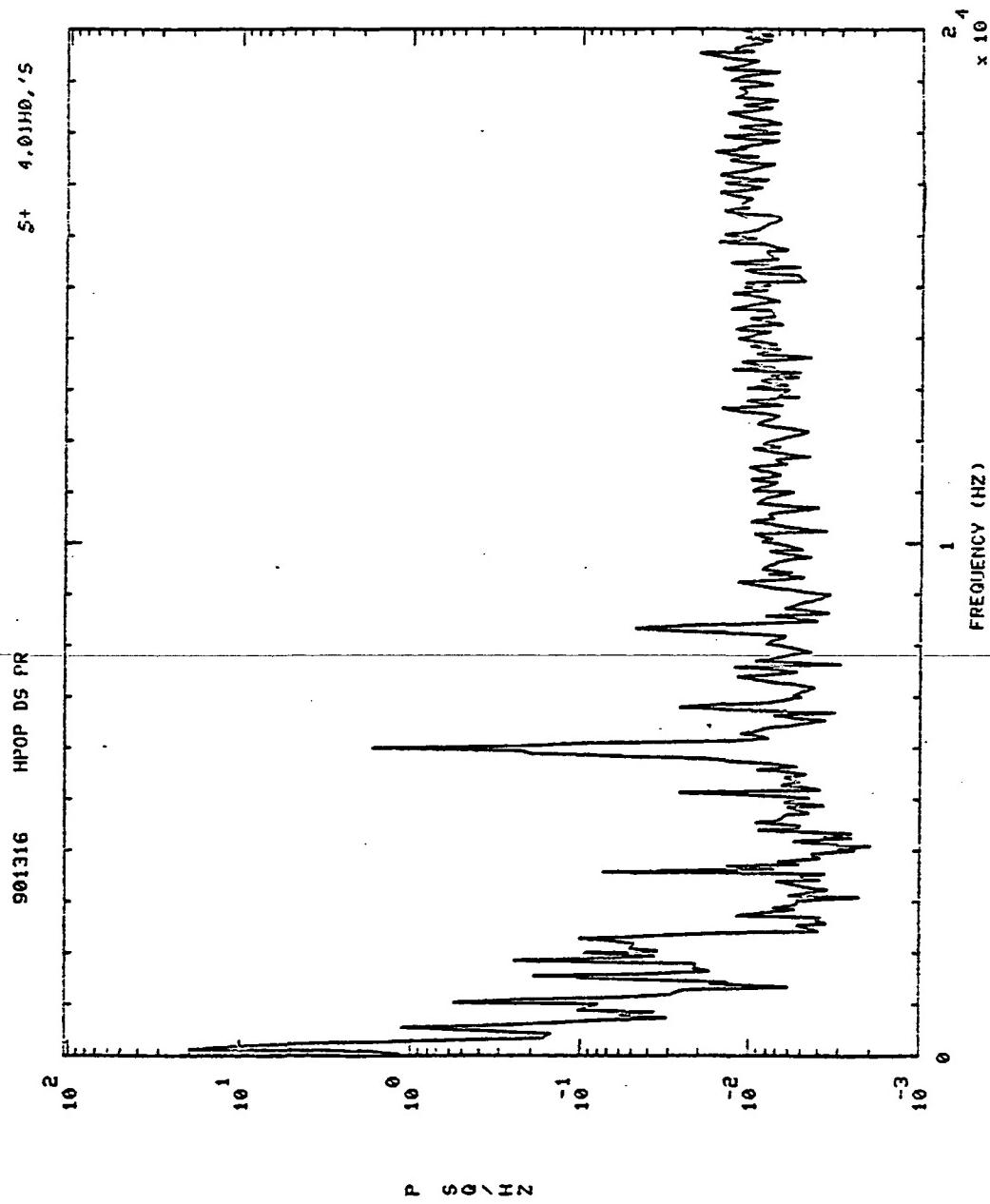
10⁻³

10⁻⁴

P
S
Q
'
H
Z

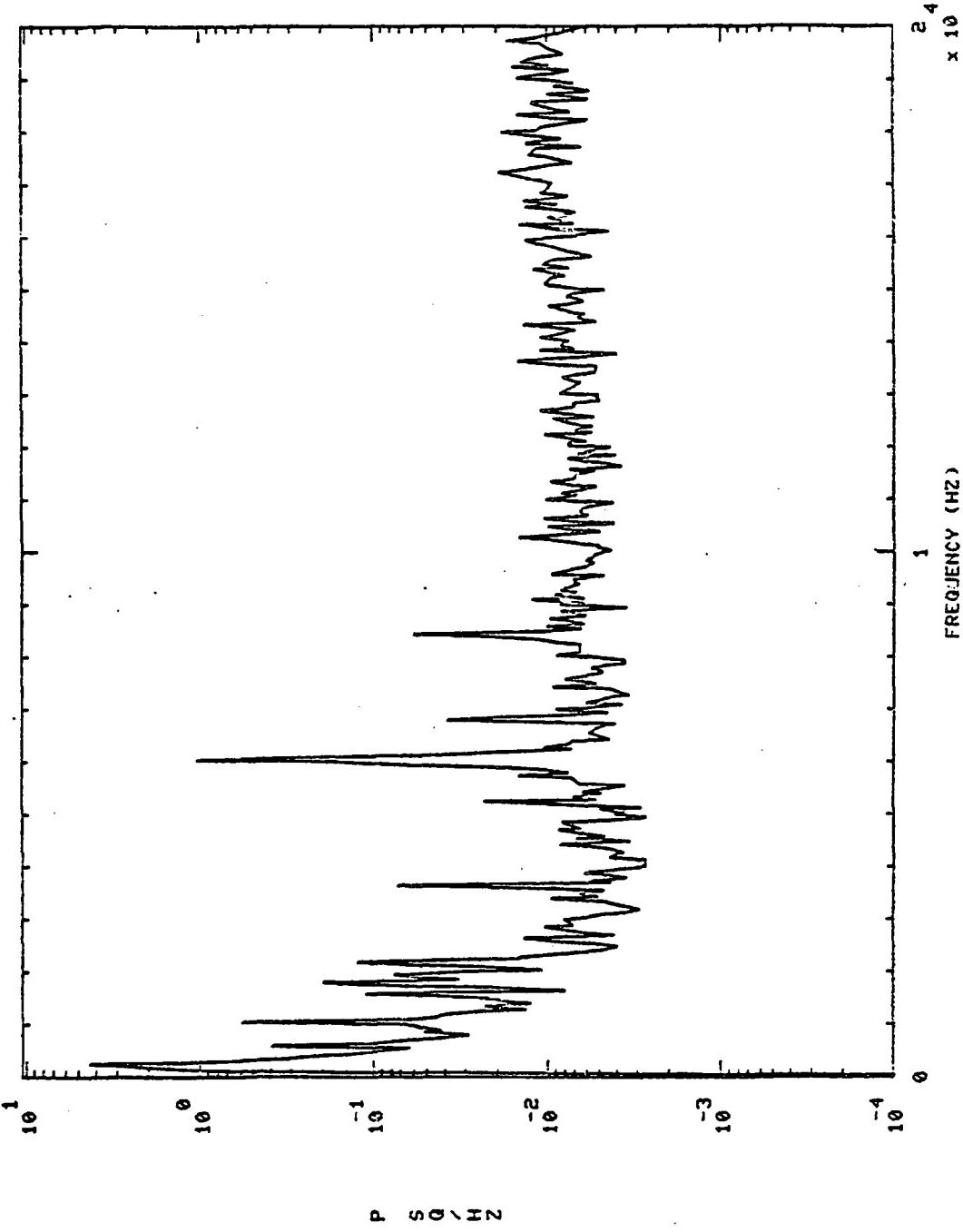
2⁴
 $\times 10$

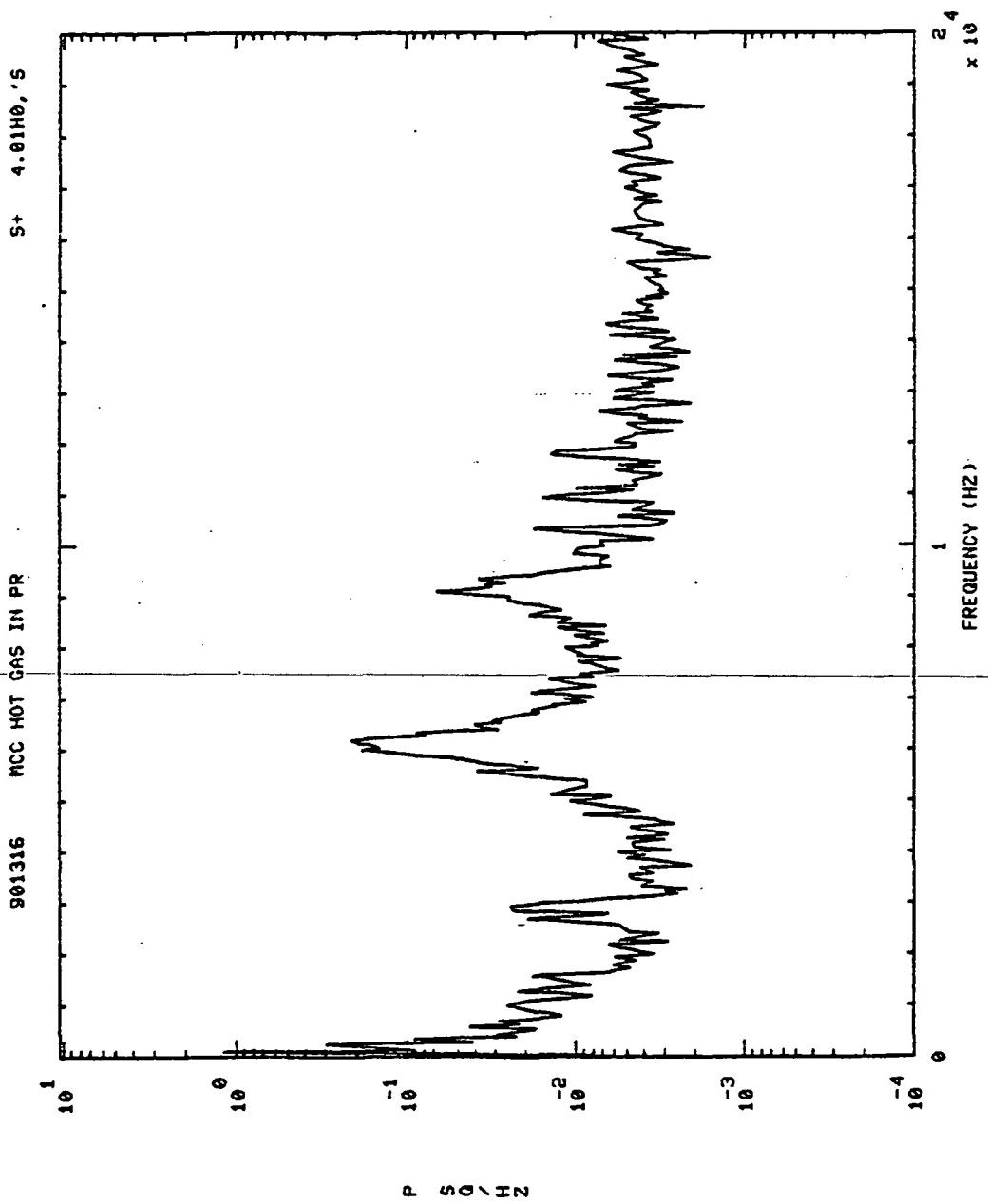
FREQUENCY (HZ)



54 31.01H0.5

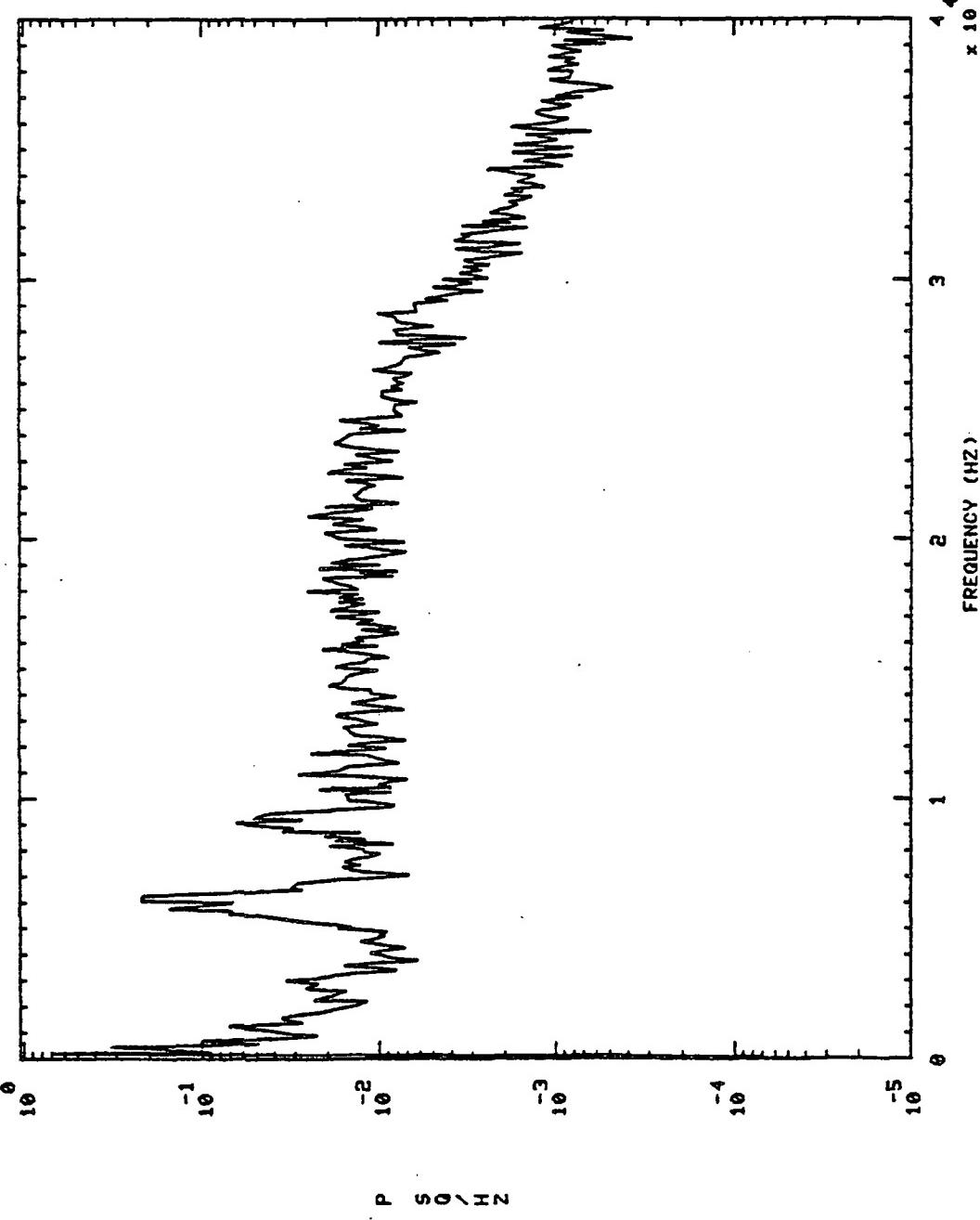
901316 HPOD DS PR

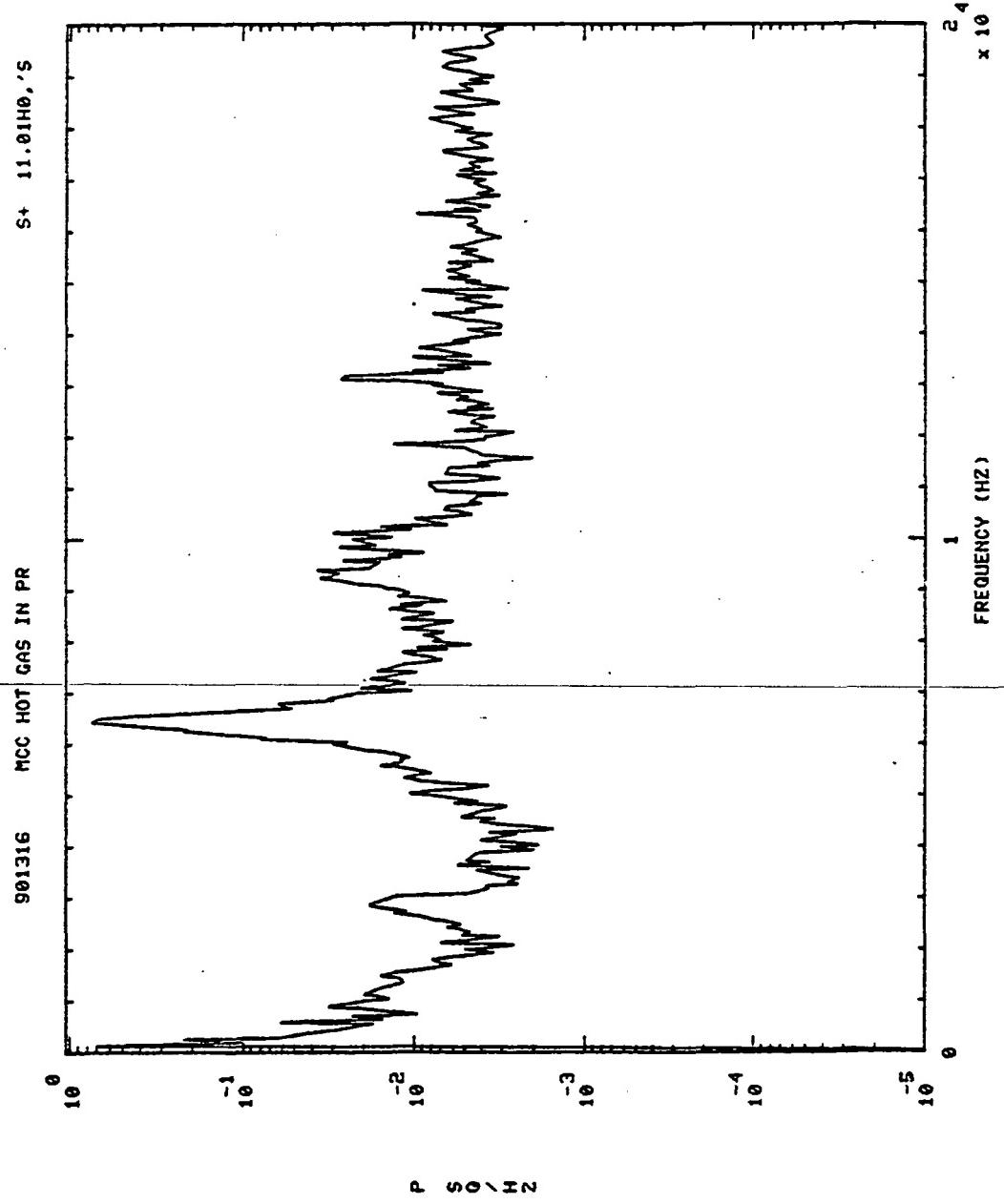




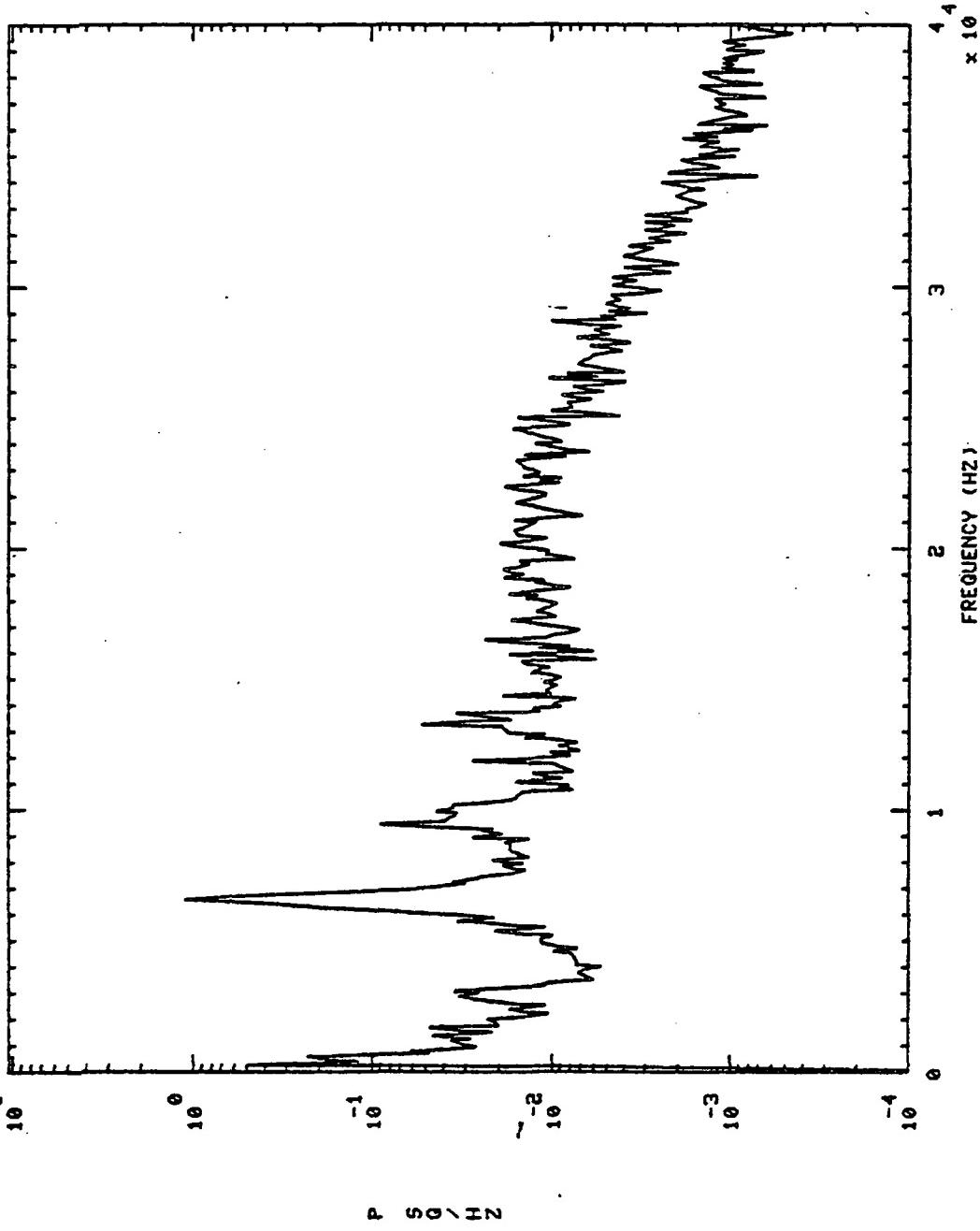
S+ 4.01MHz, 'S'

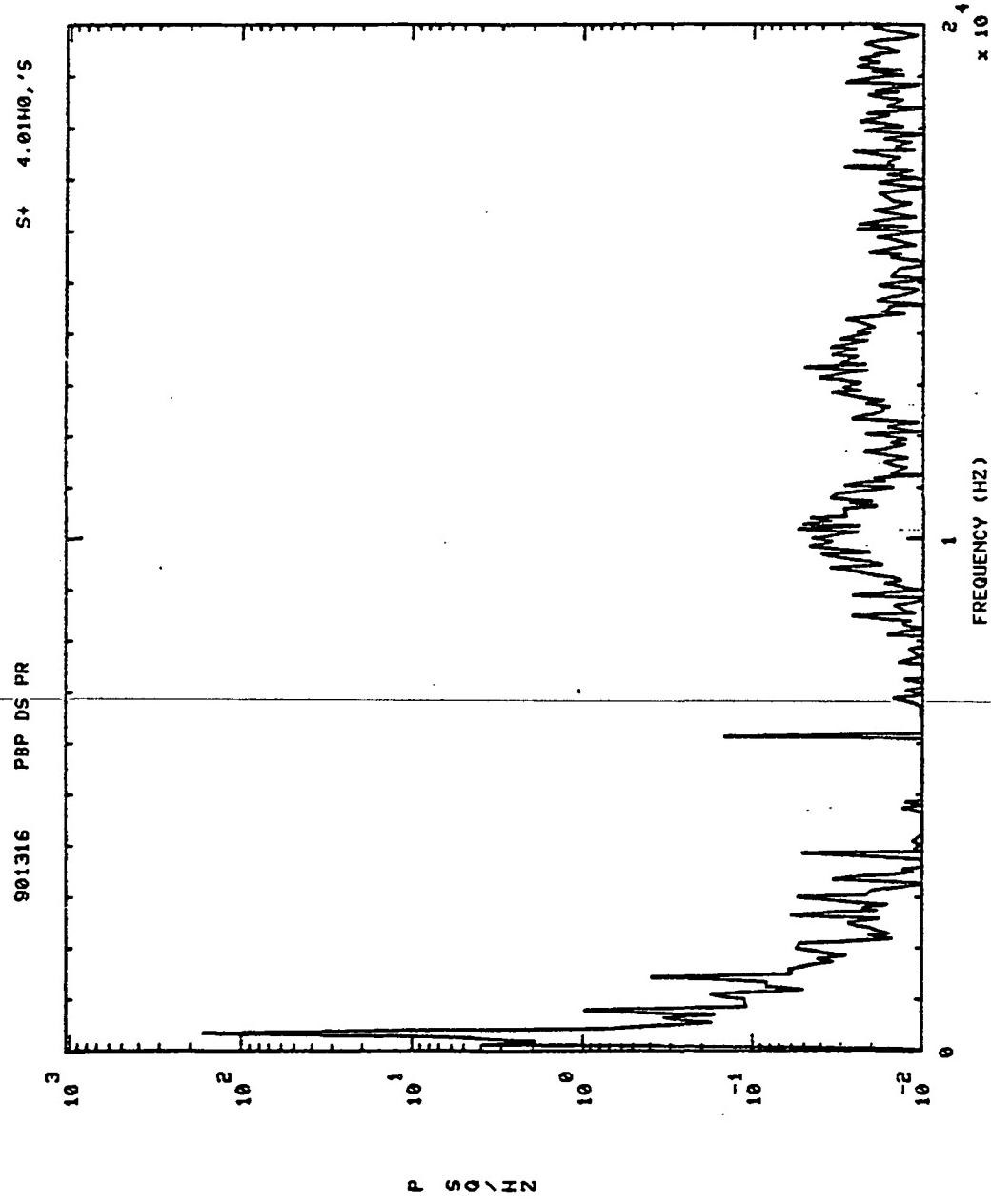
901316 MCC HOT GAS IN PR



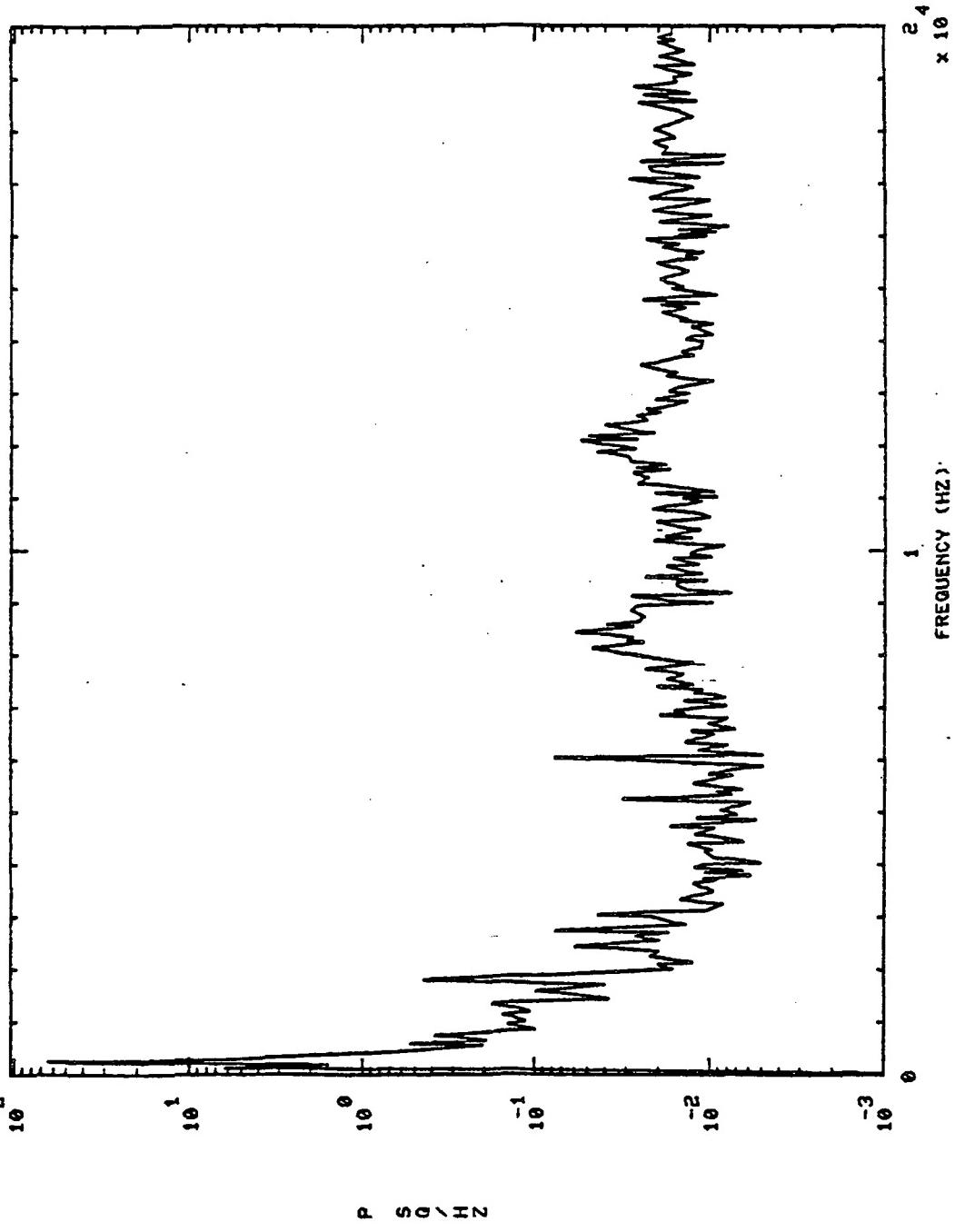


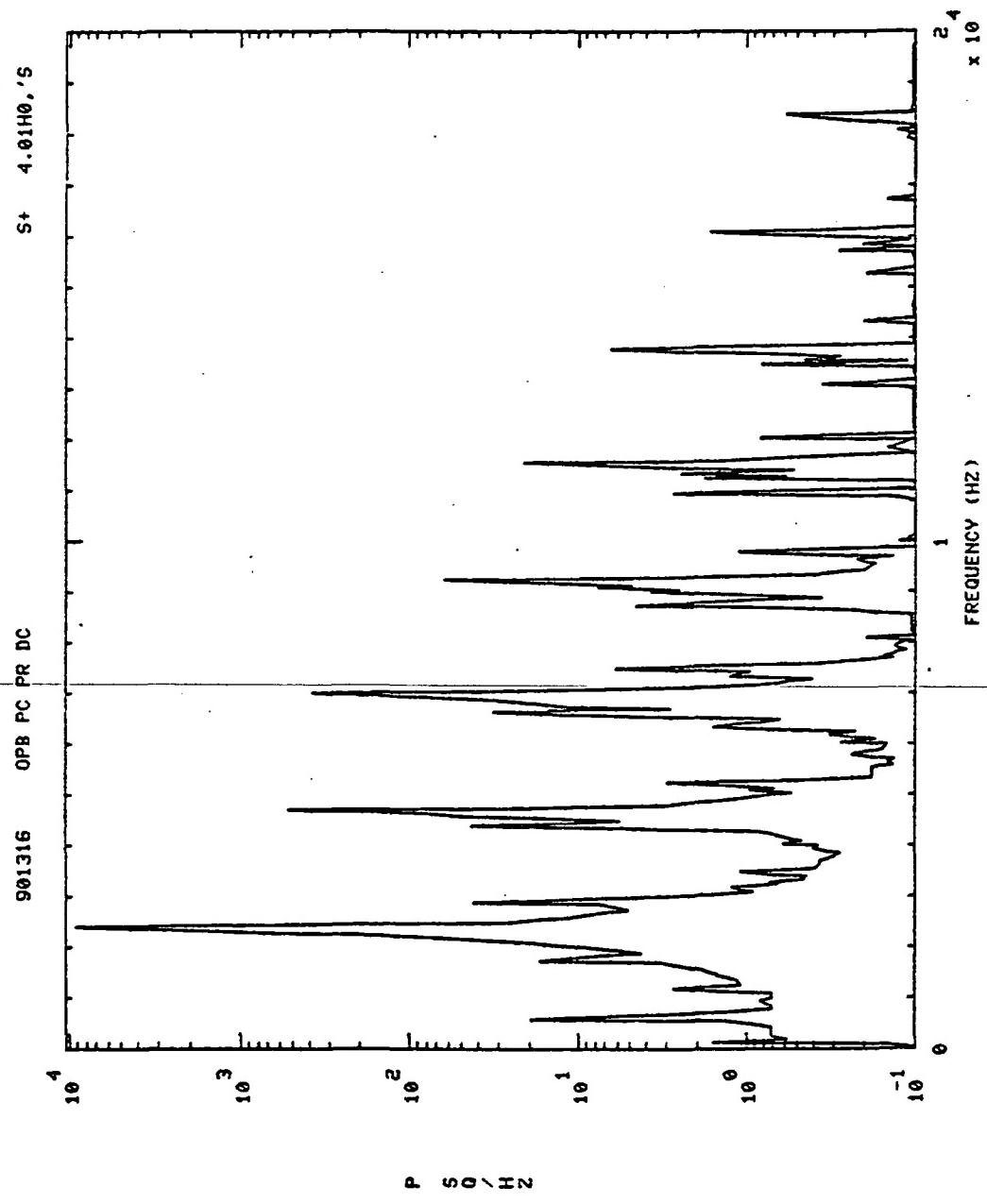
S+ 11.01H0, 'S
901316 MCC HOT GAS IN PR
P S G / HZ





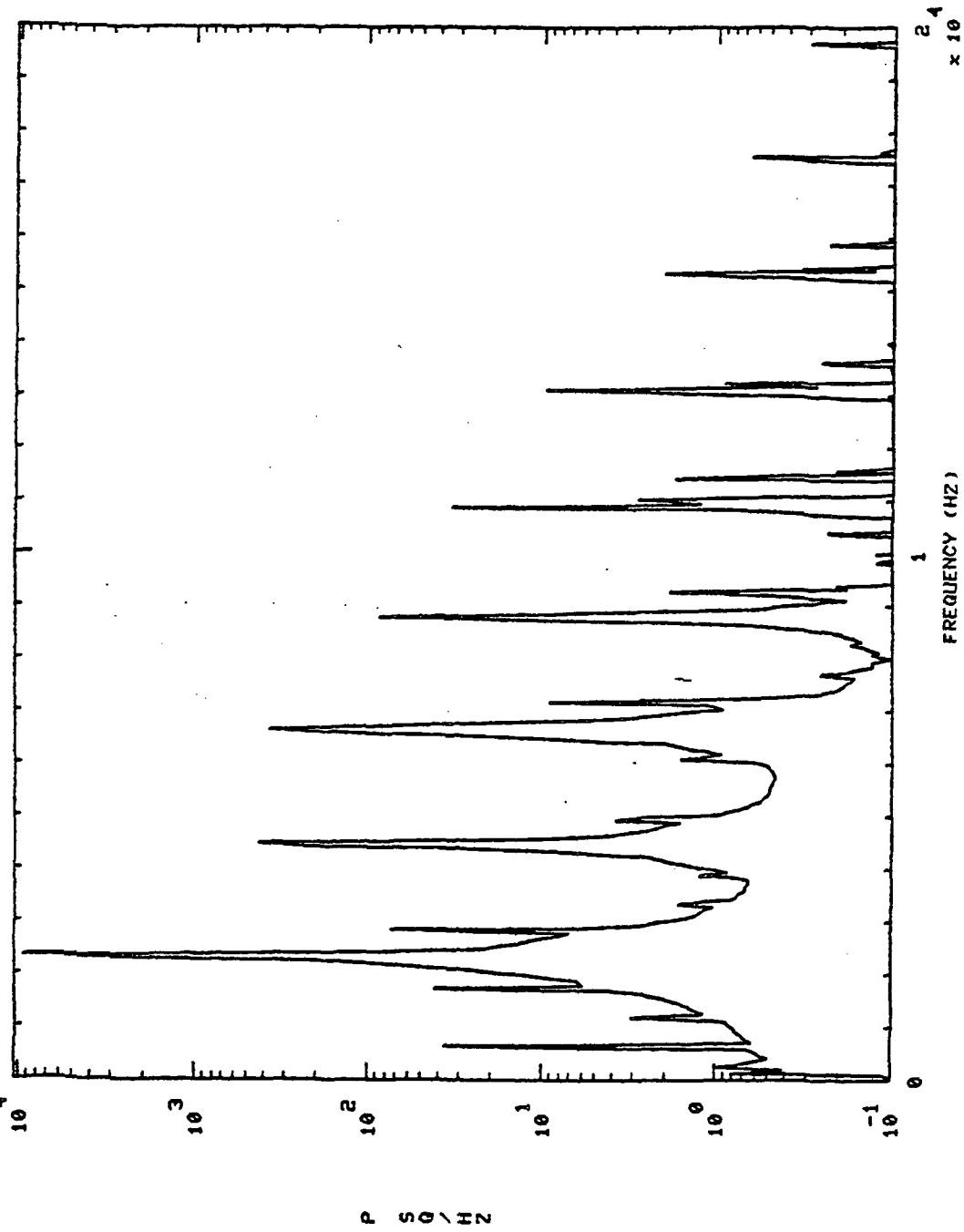
901316 PBP DS PR S+ 11.01HQ, S

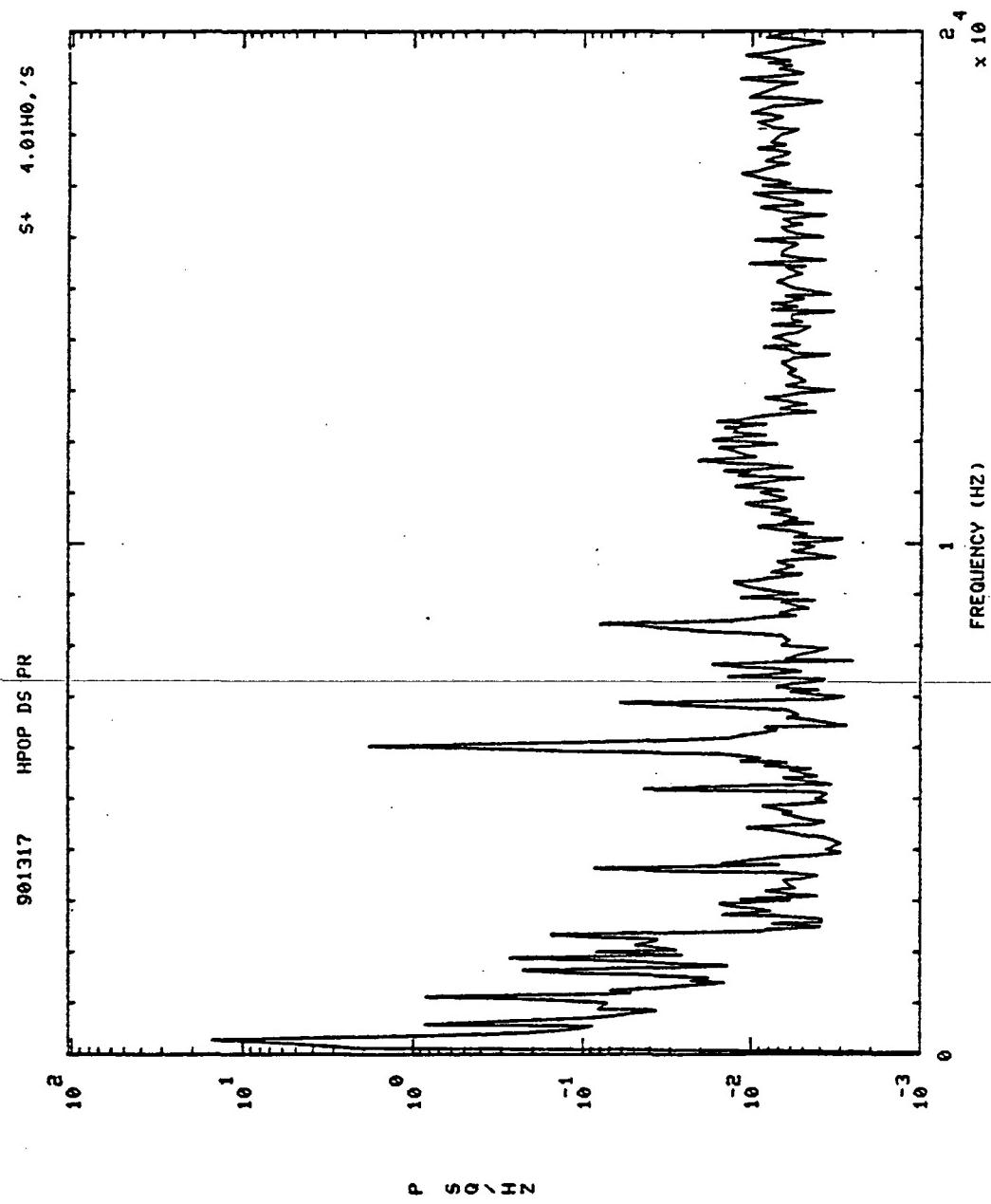




S+ 11.01H0, 'S

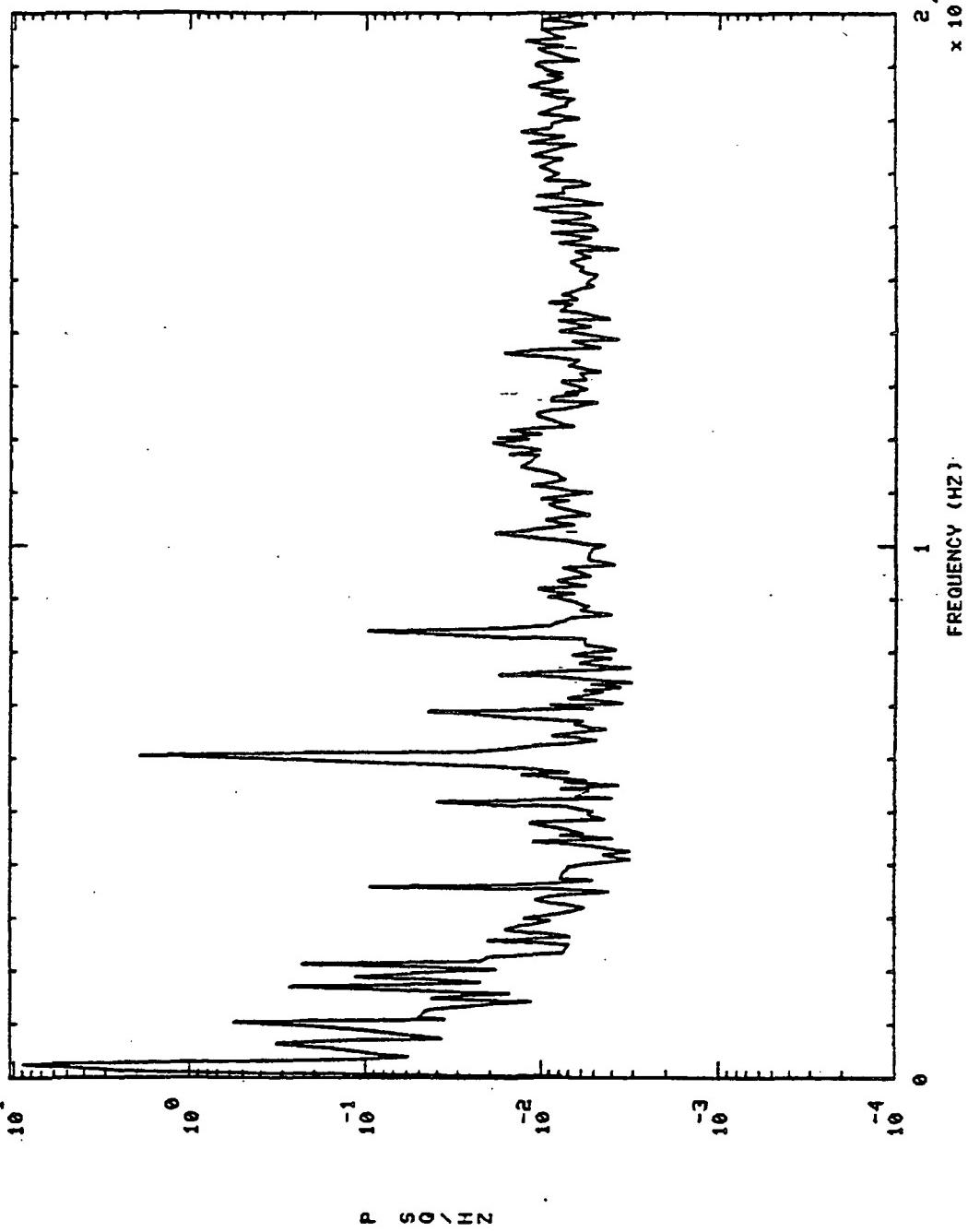
9001316 OPB PC PR DC



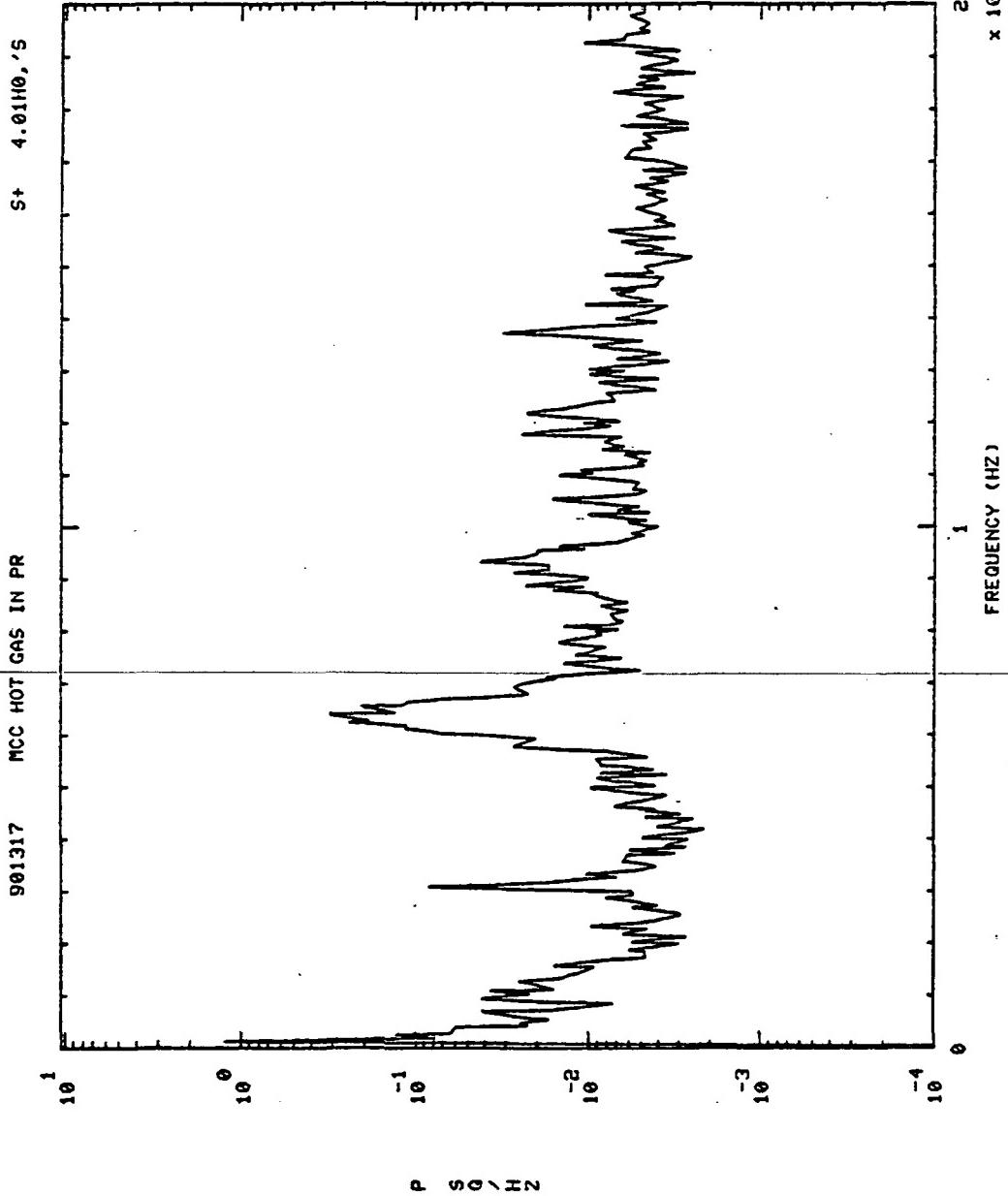


S+ 11.01H0, /S

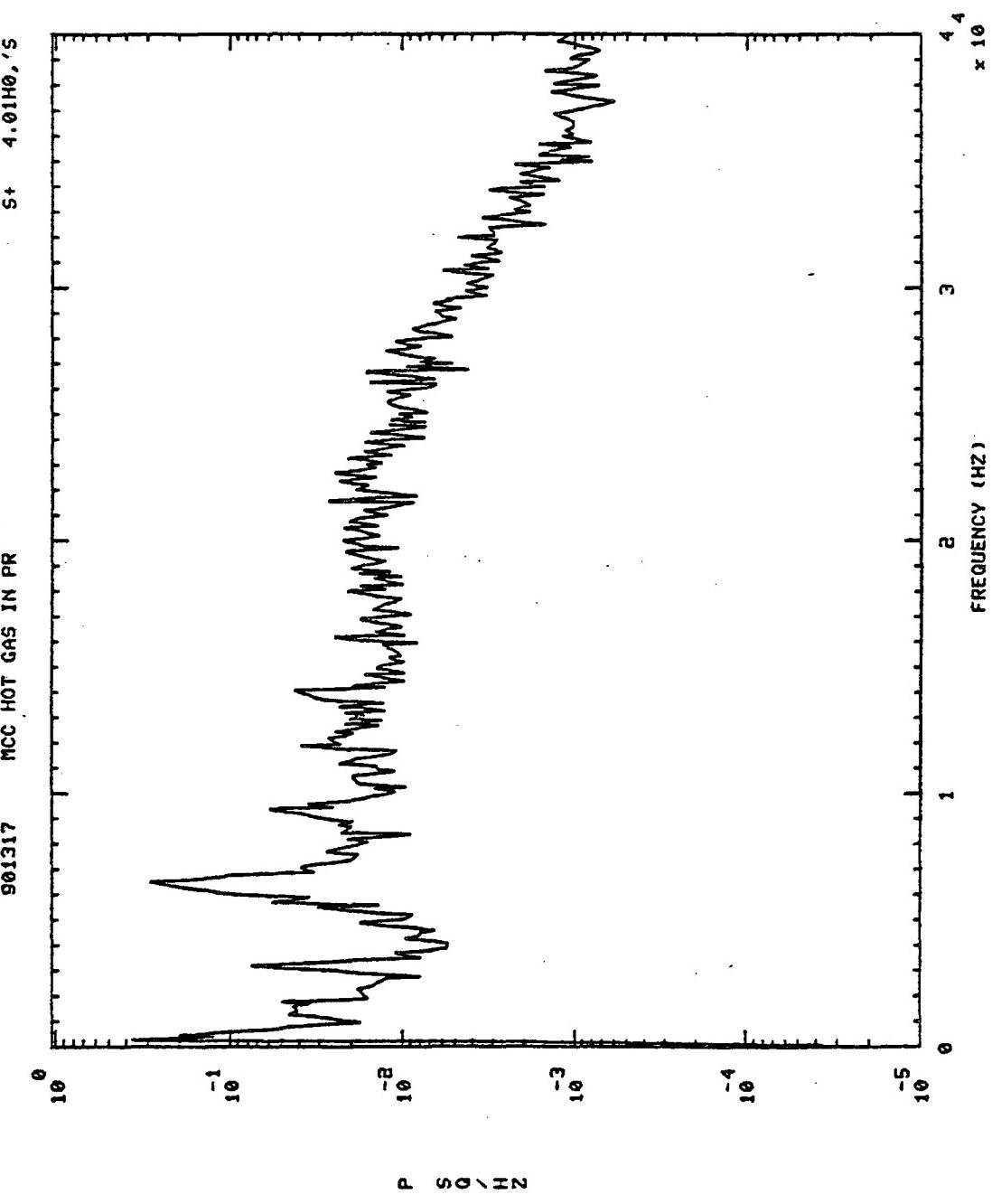
901317 HPOP DS PR

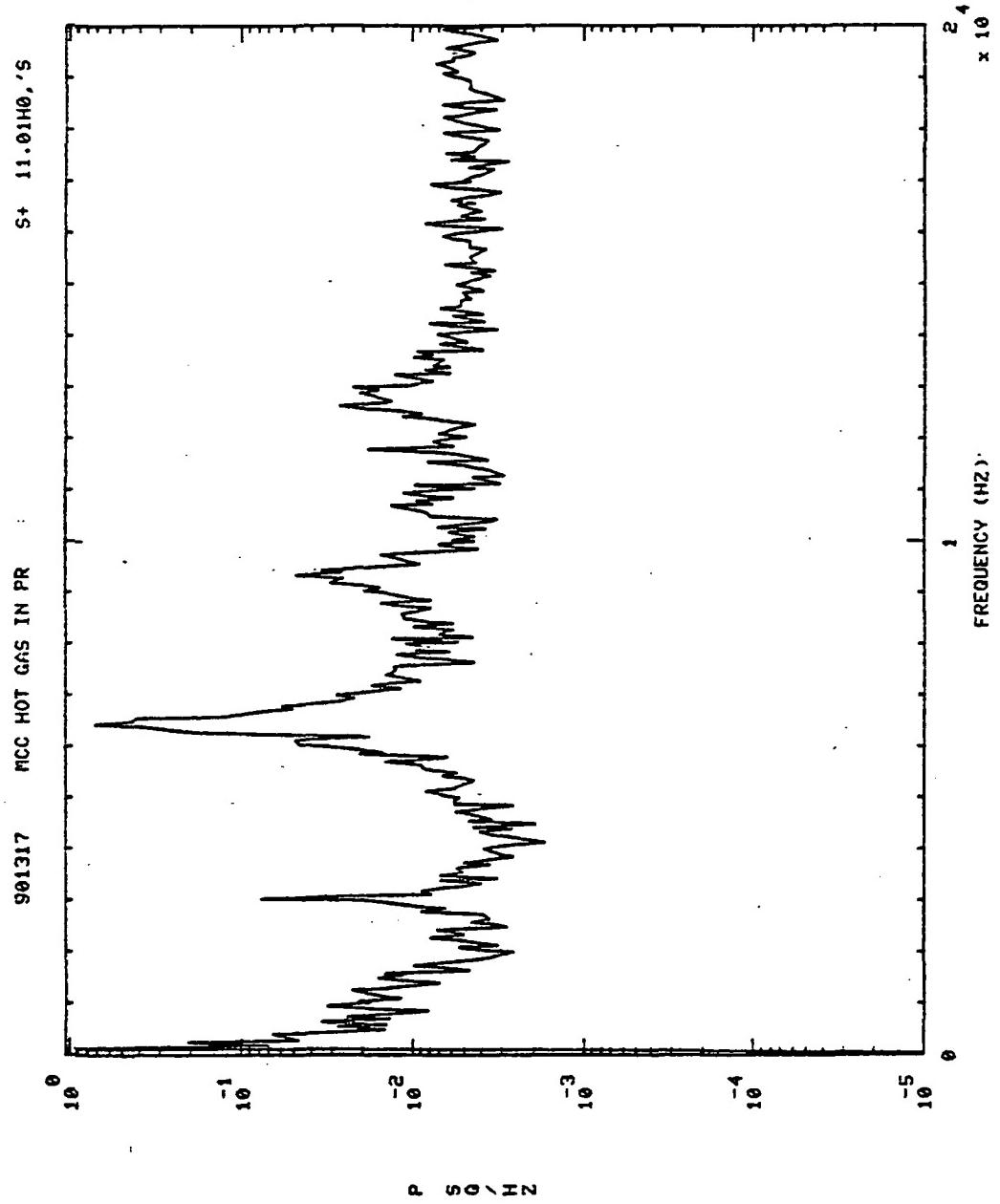


P S Q /Hz



901317 MCC HOT GAS IN PR

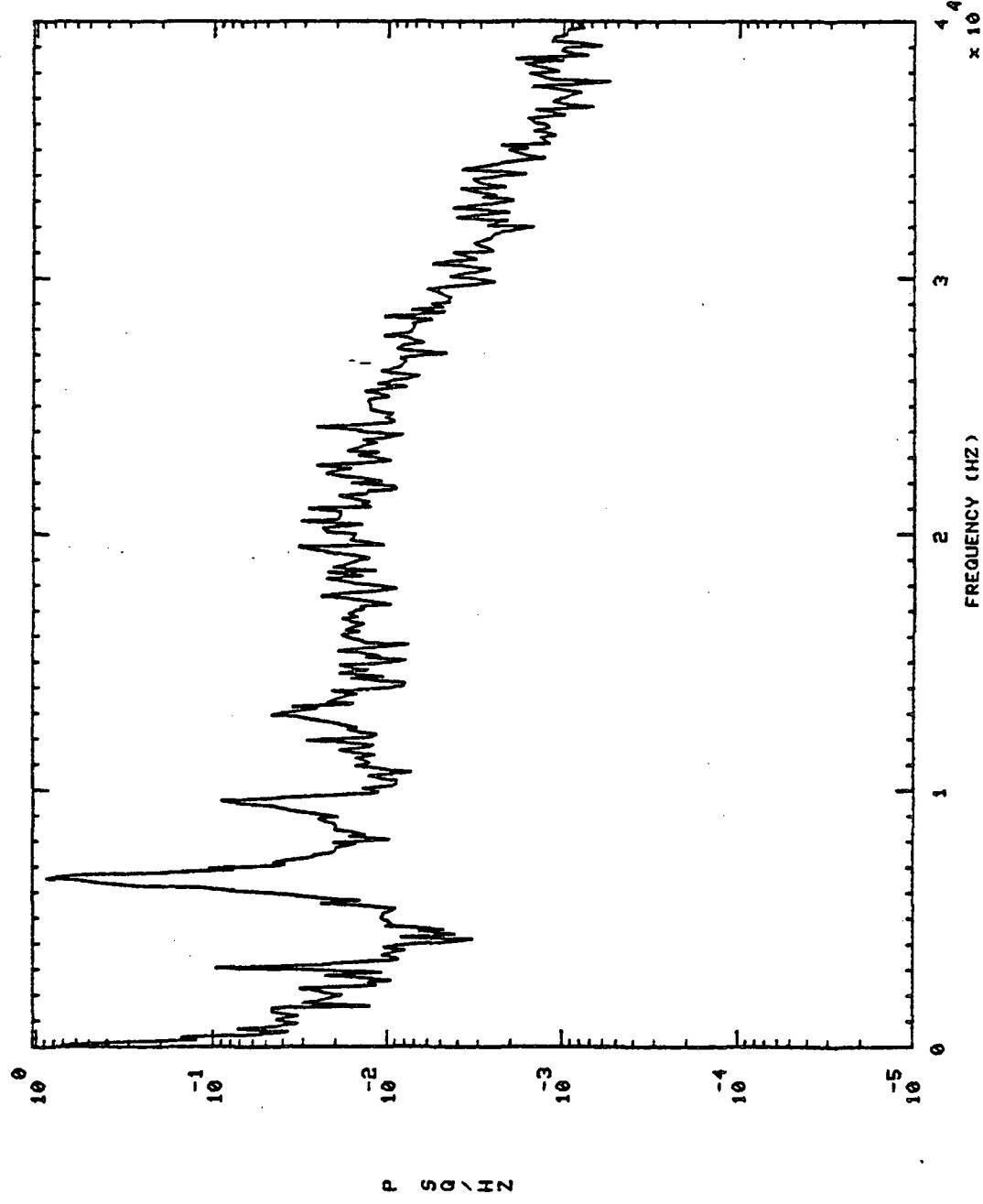


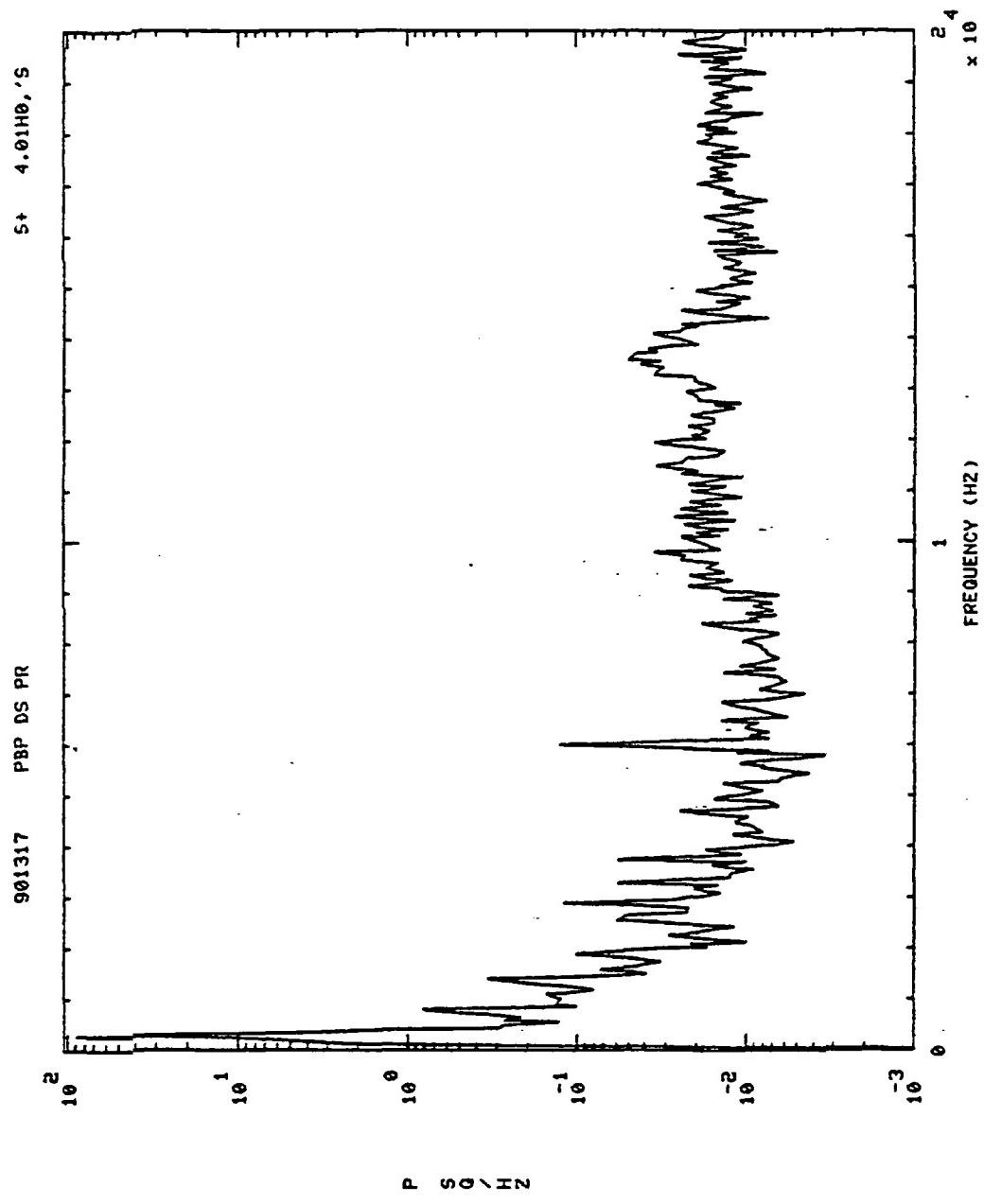


S+ 11.01H0.'S

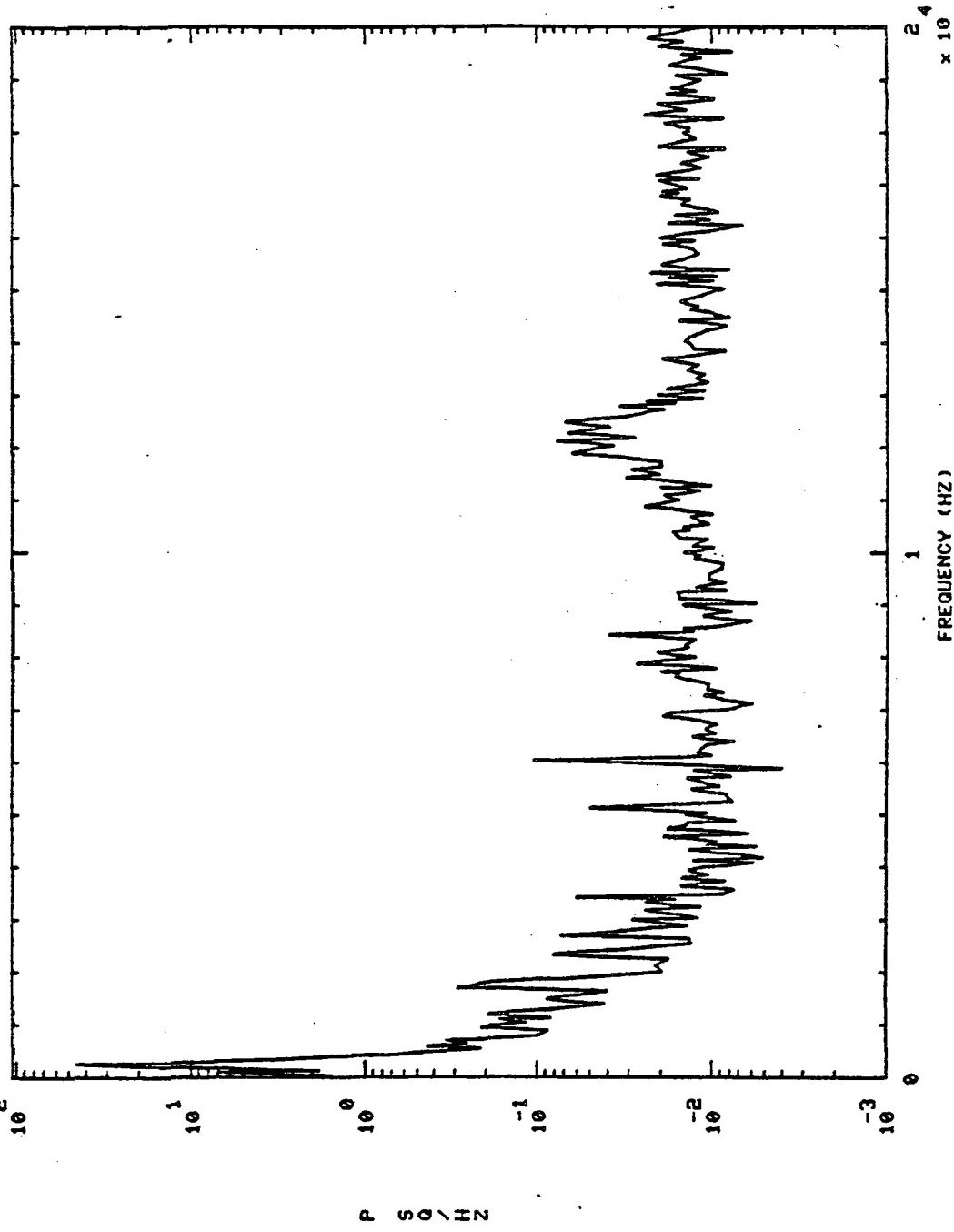
MCC HOT GAS IN PR

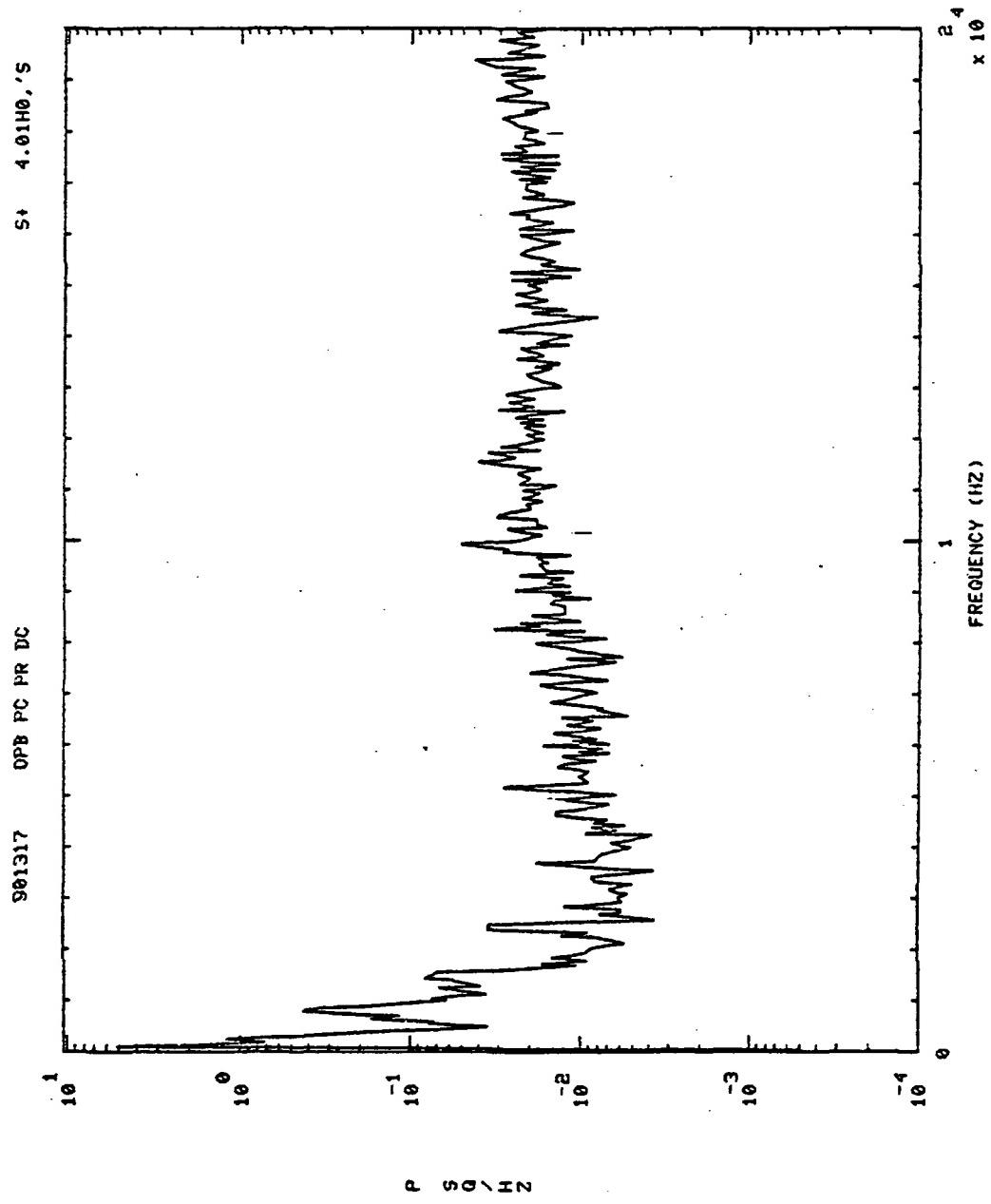
901317





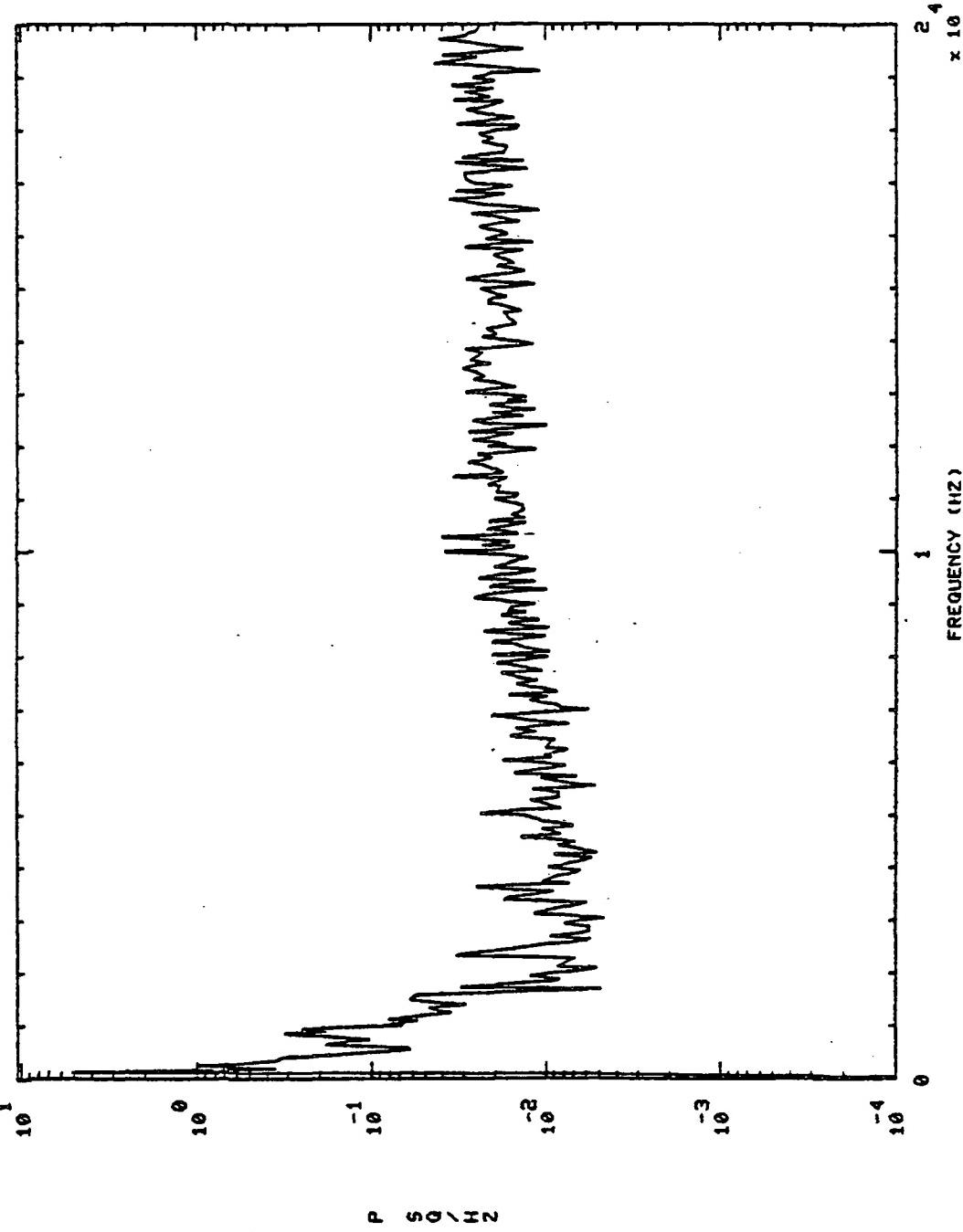
901317 PBP DS PR S+ 11.01H0.'S

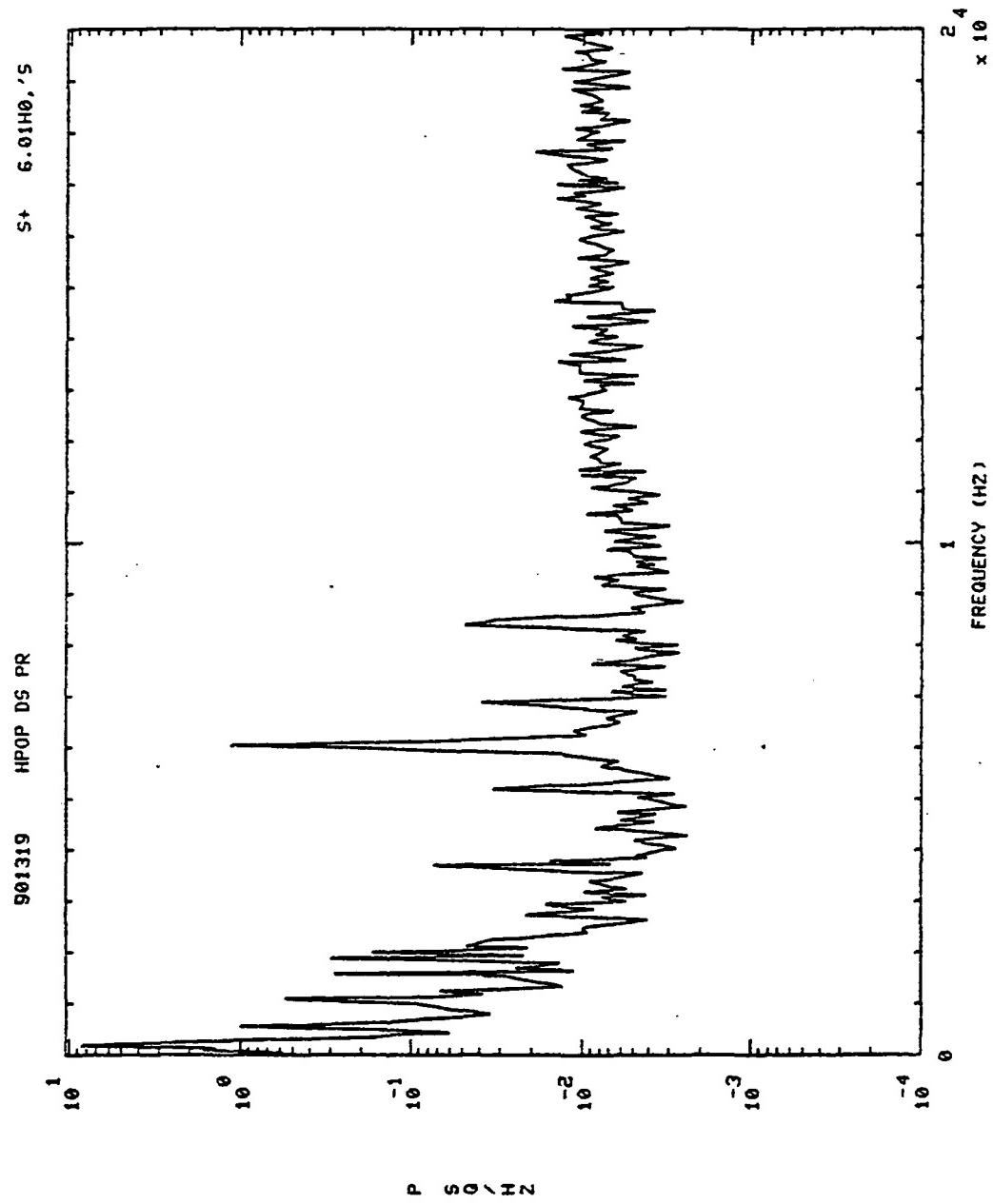




S+ 11.01H0.'S

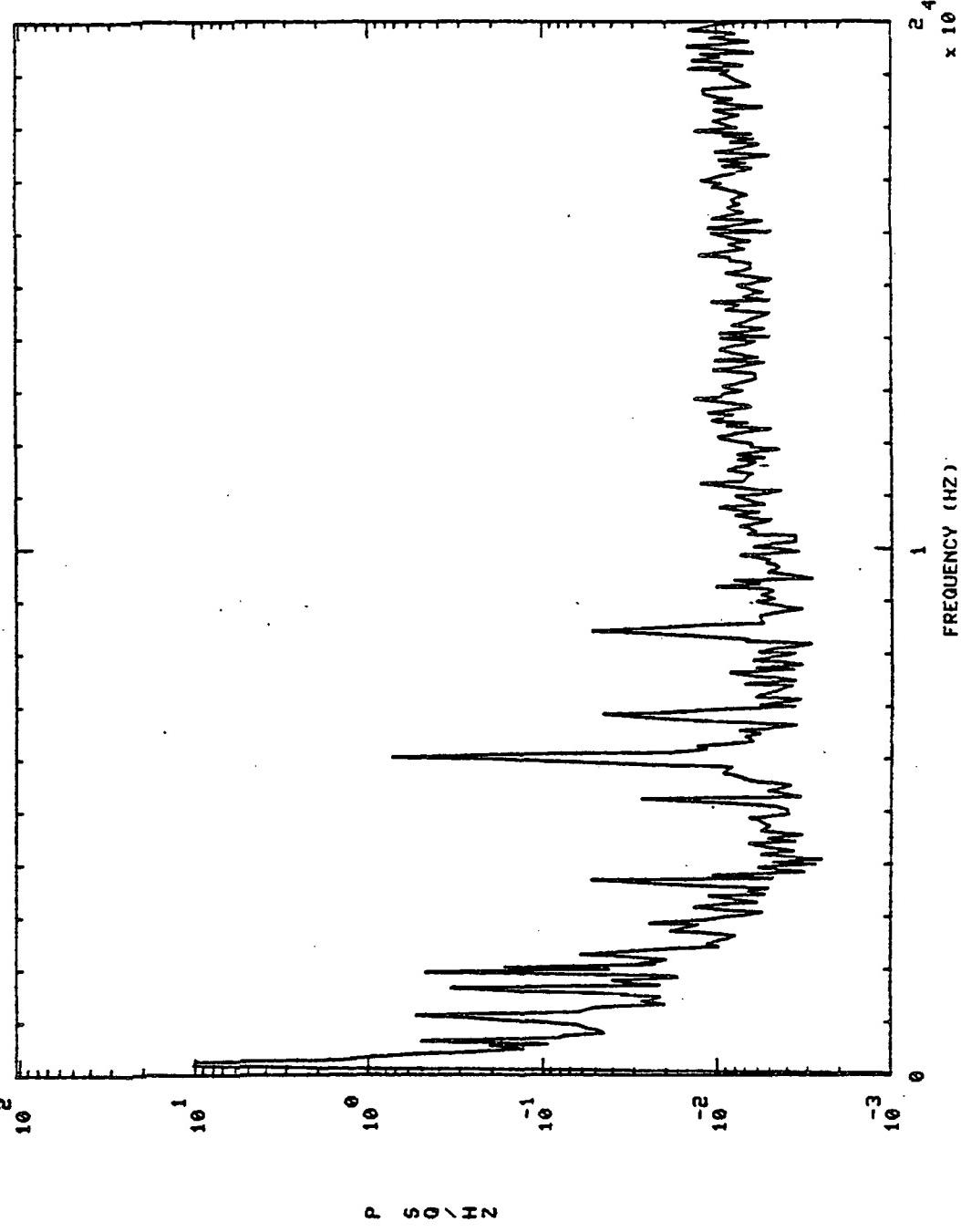
901317 OPB PC PR DC

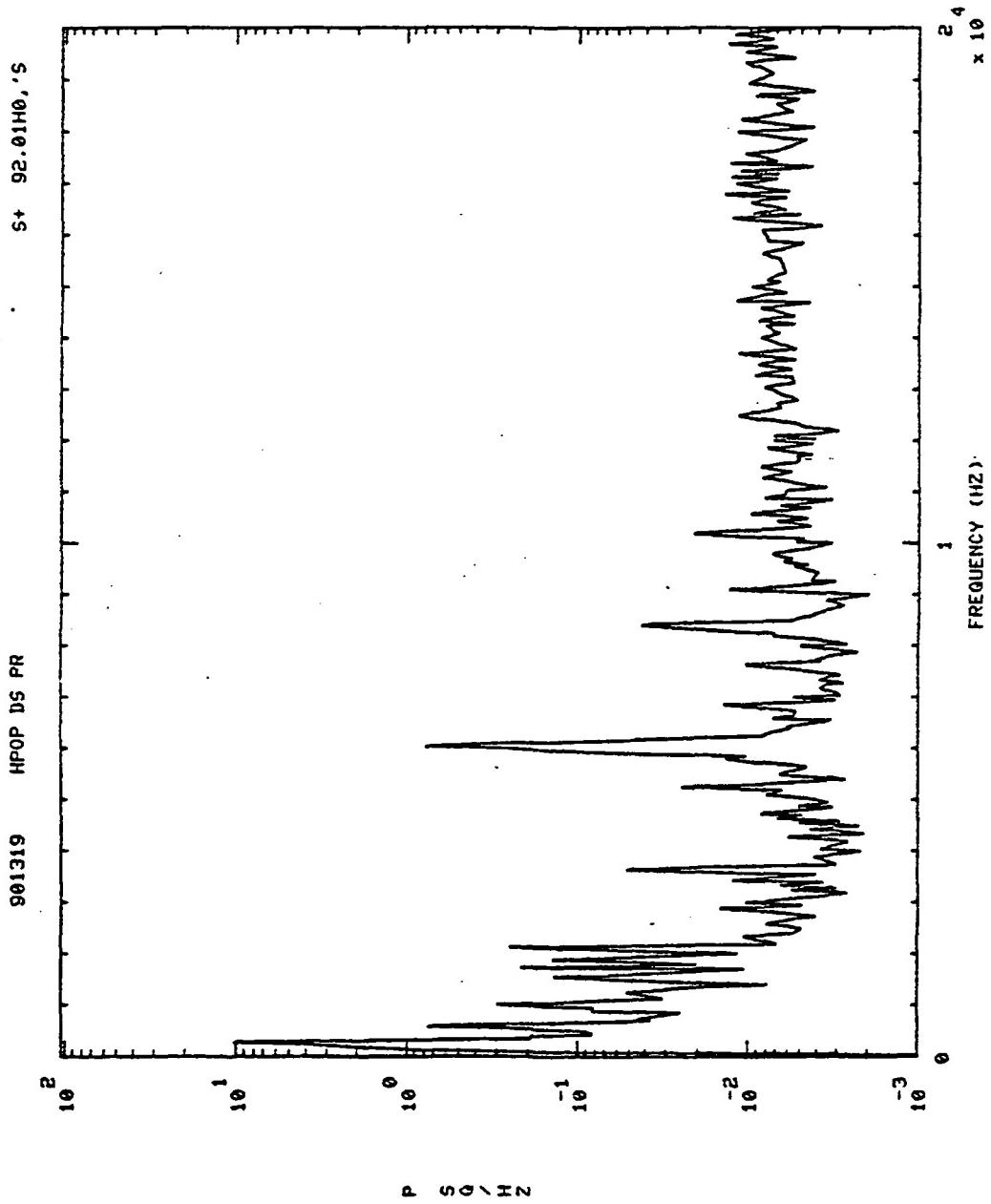




5+ 30.01H0.'S

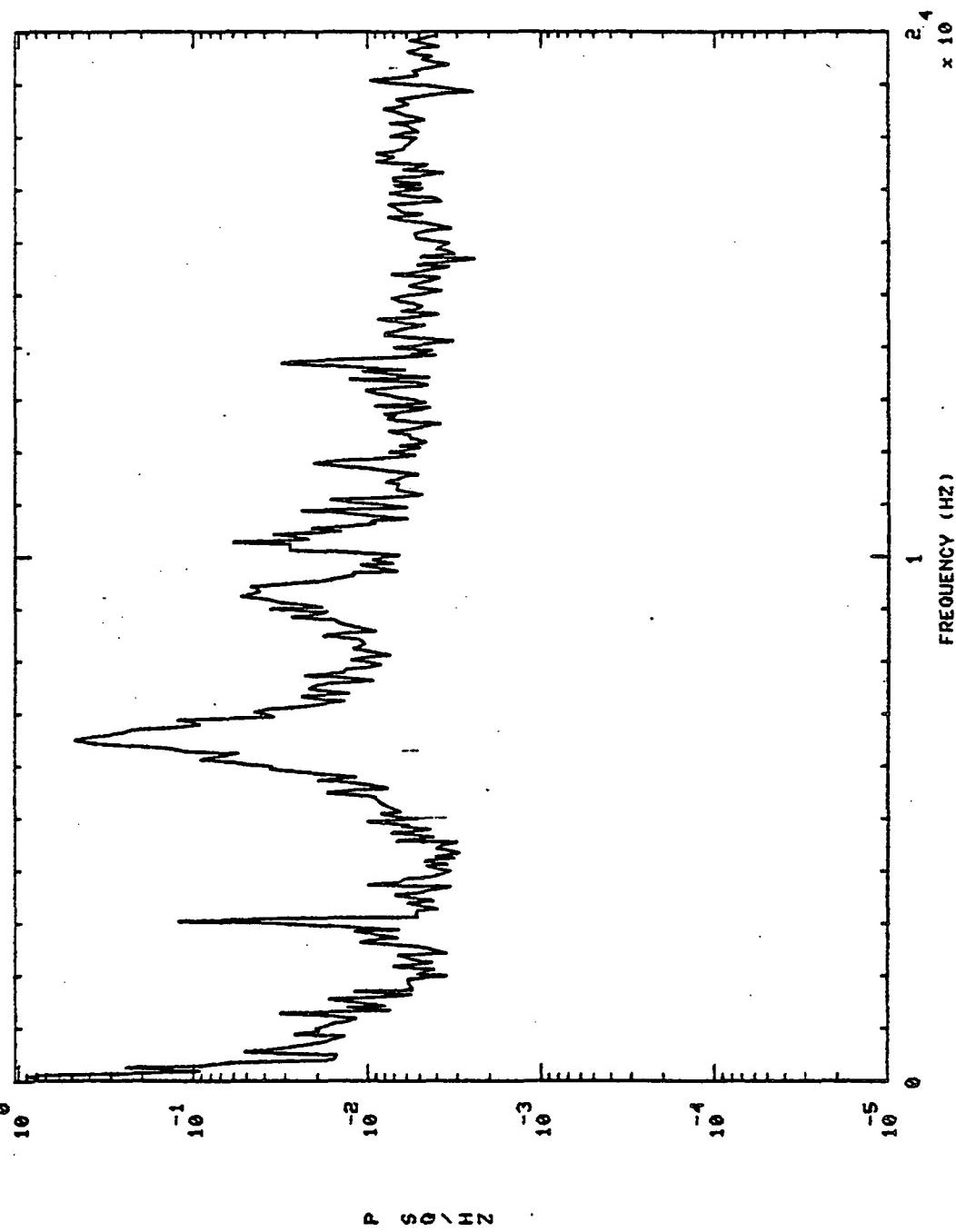
901319 HPOP DS PR

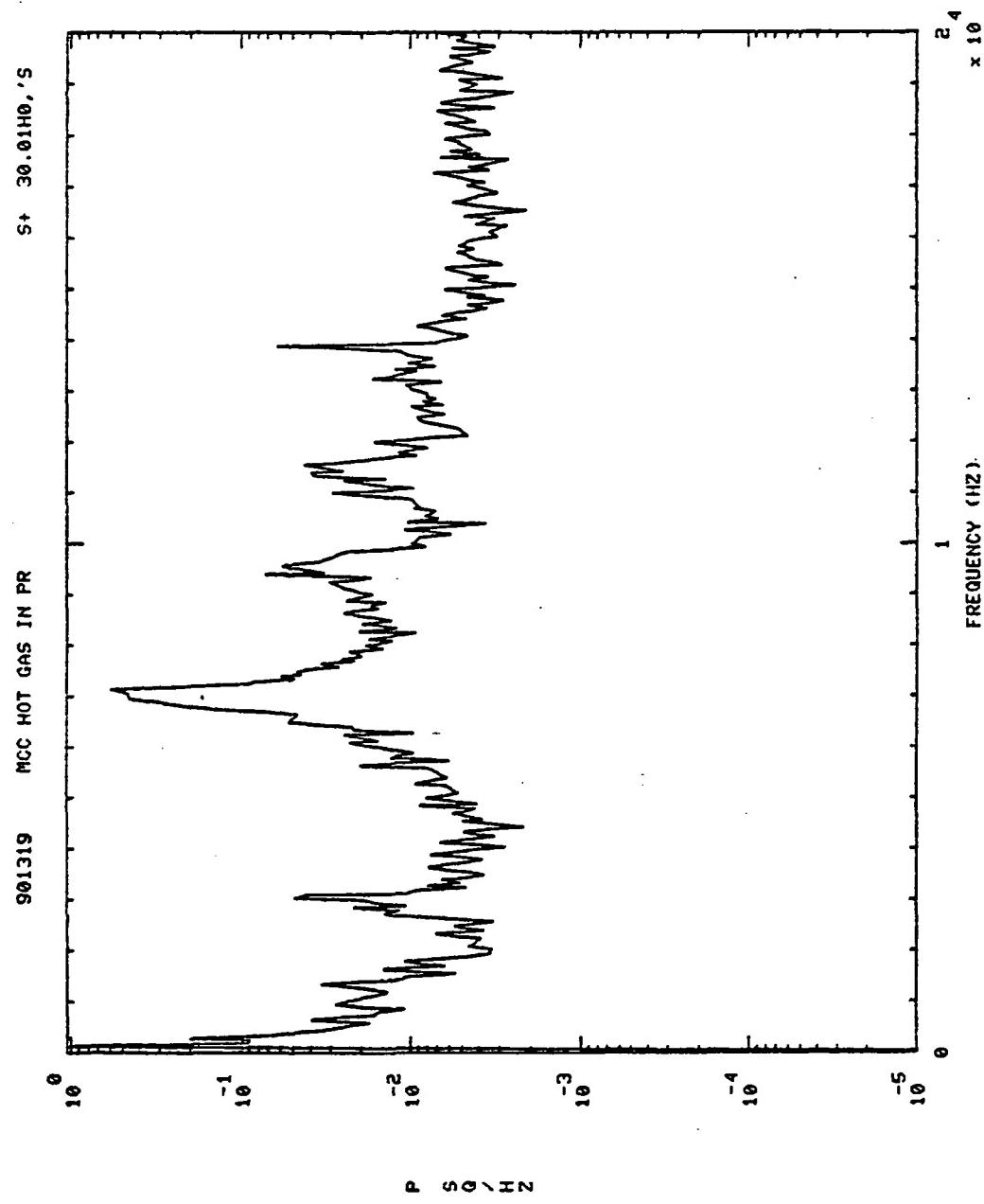




5+ 6.01H0, 5

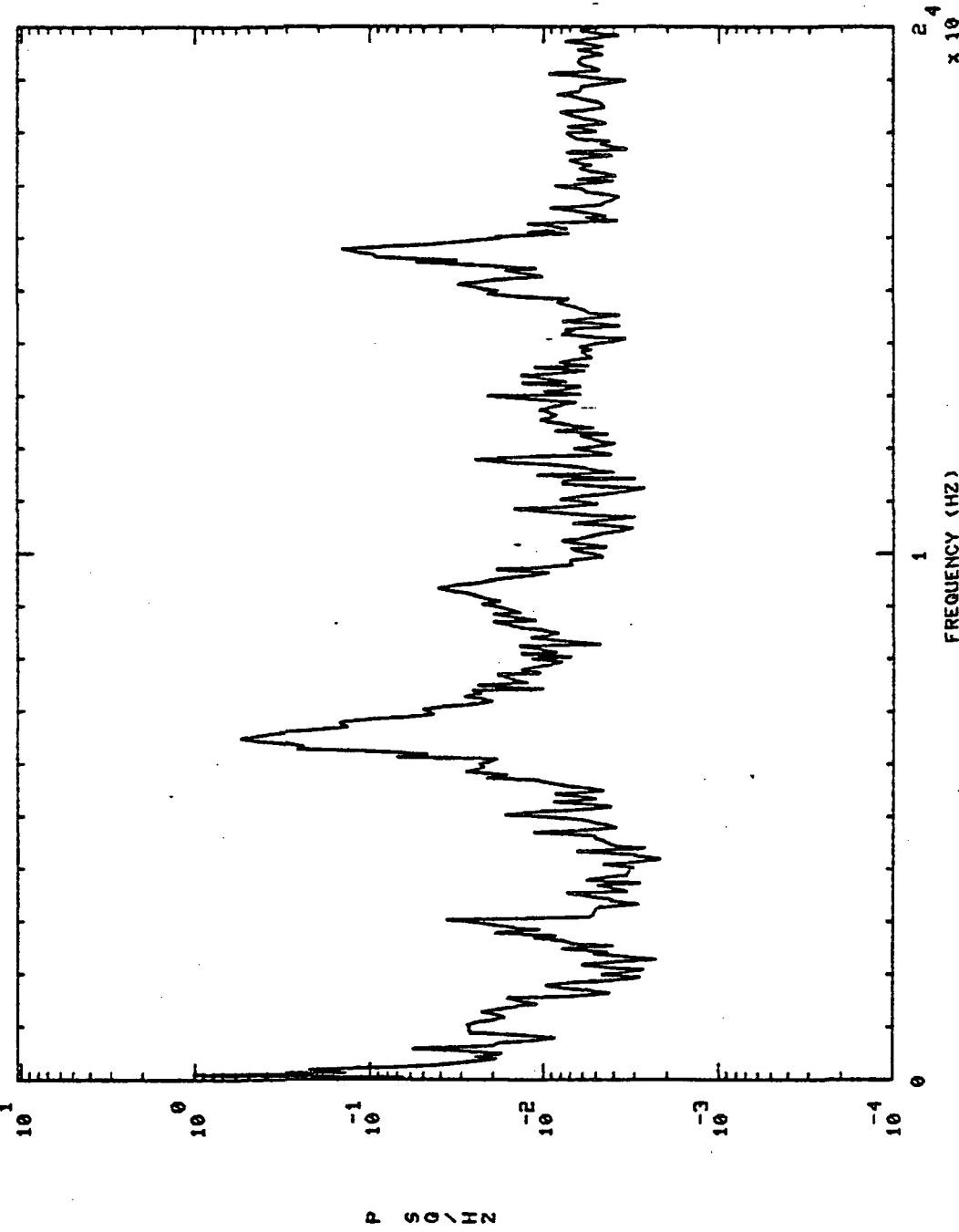
901319 MCC HOT GAS IN PR

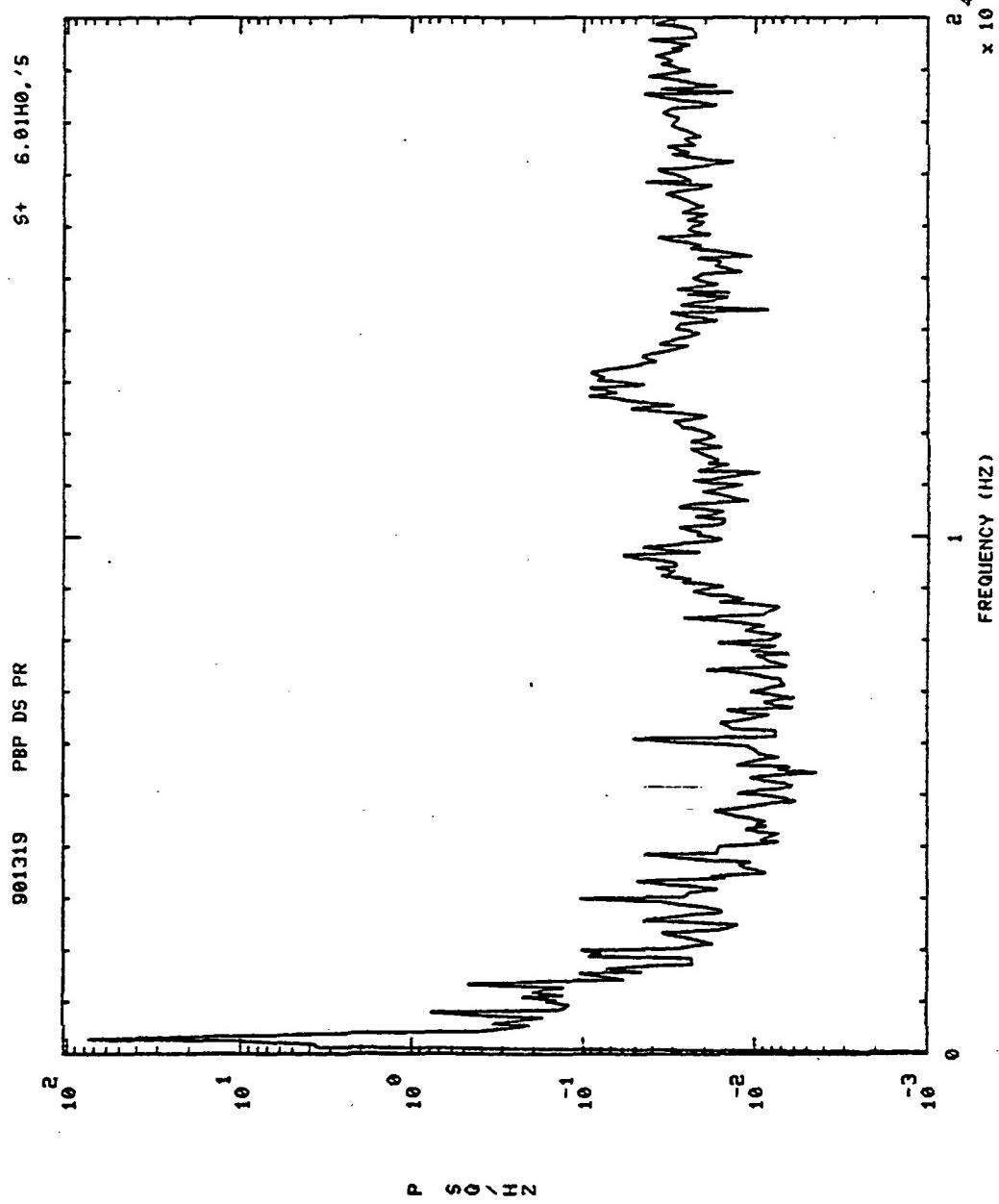




S+ 92.01H0.'6

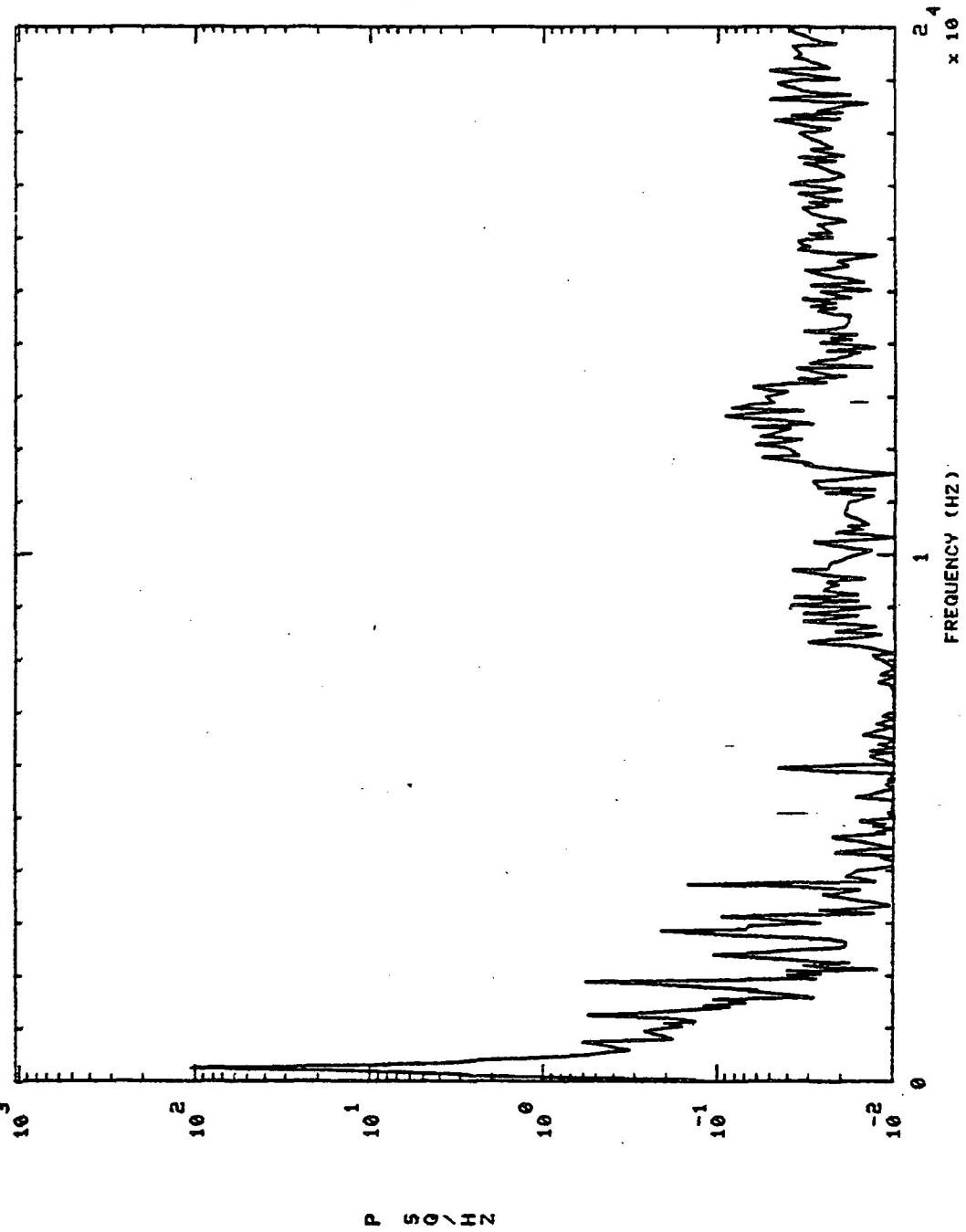
961319 MCC HOT GAS IN PR



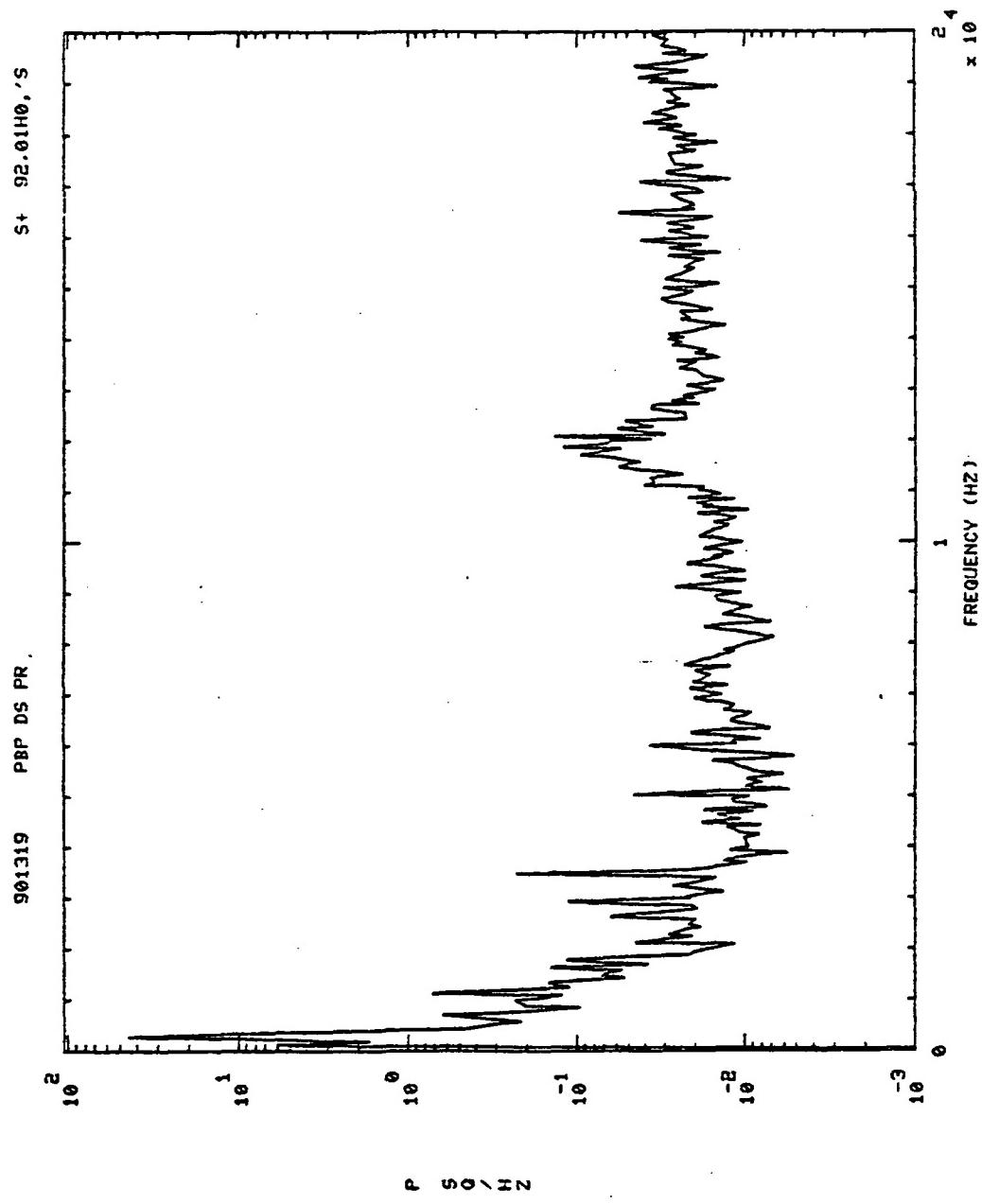


S+ 30.01H0.'S

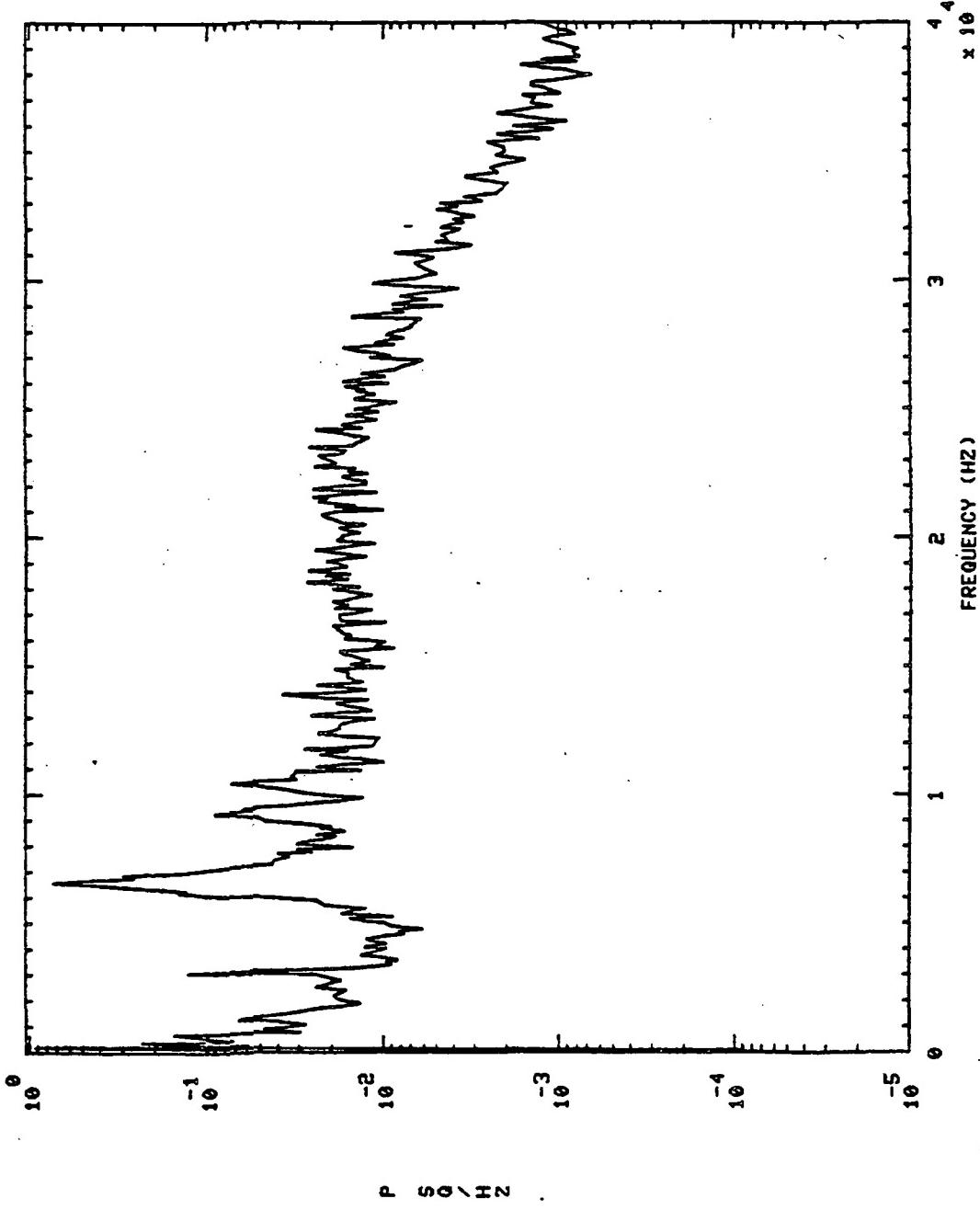
901319 PBP DS PR

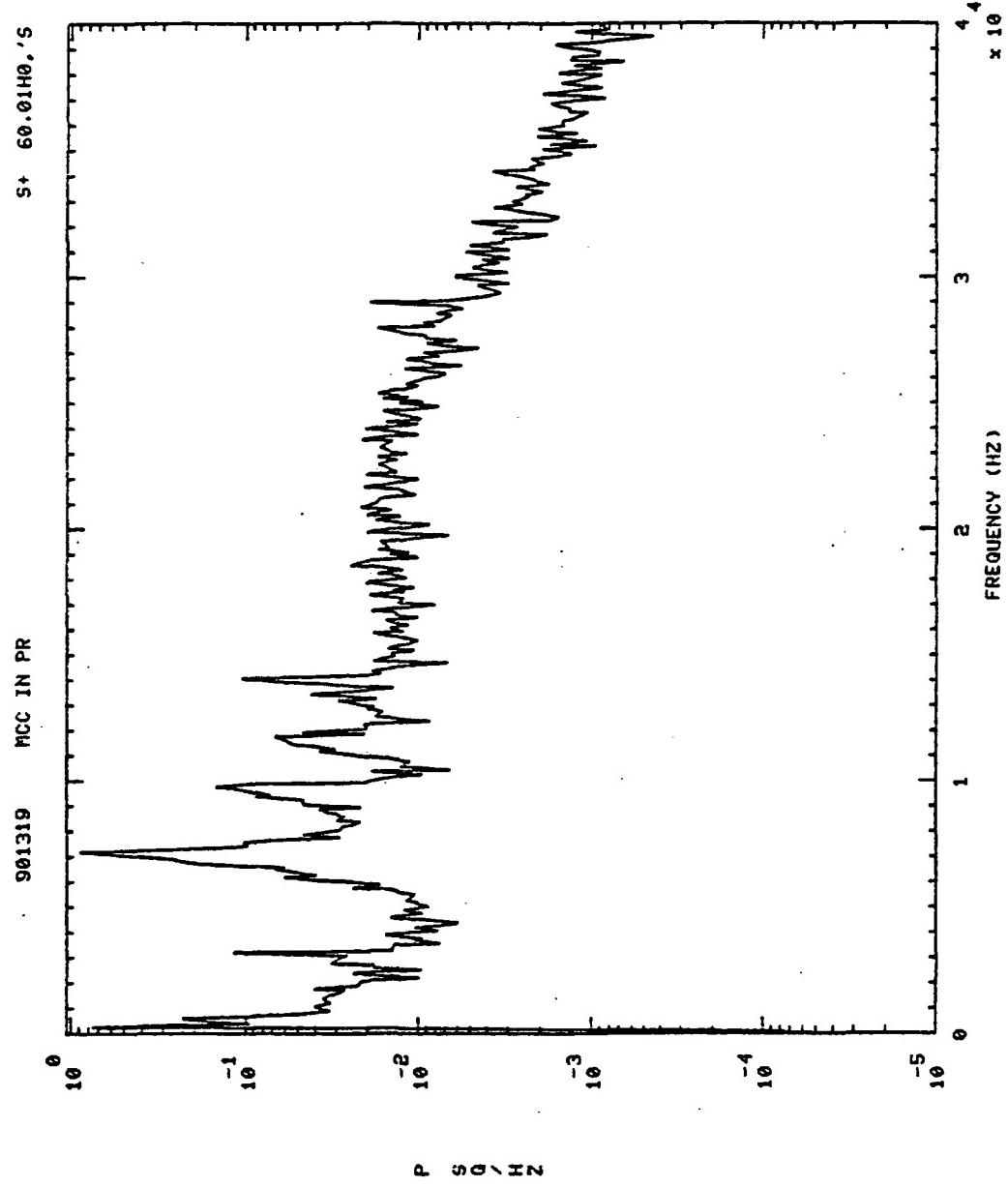


C - 4



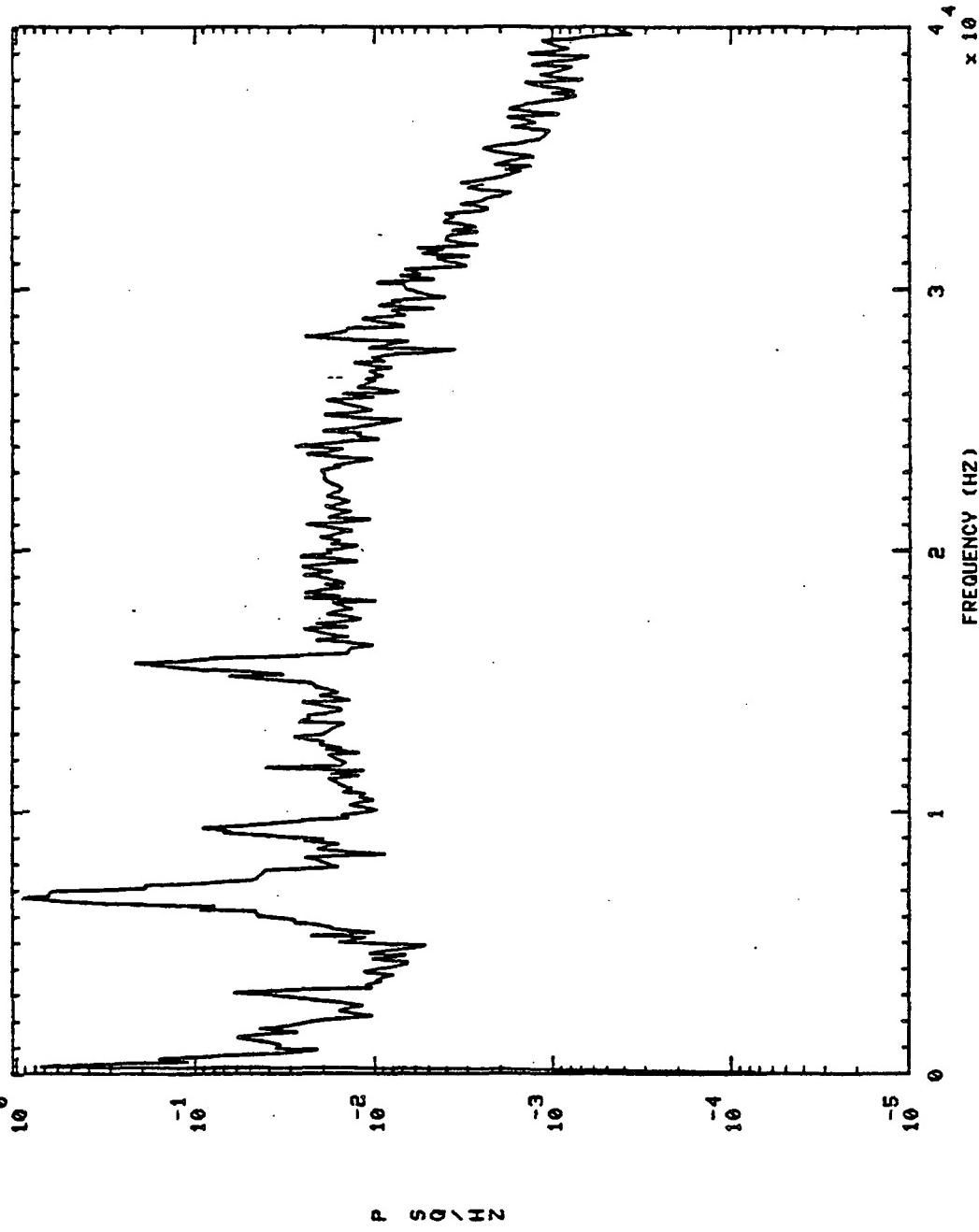
901319 PCCG IN PR S+ 12.01HQ.75

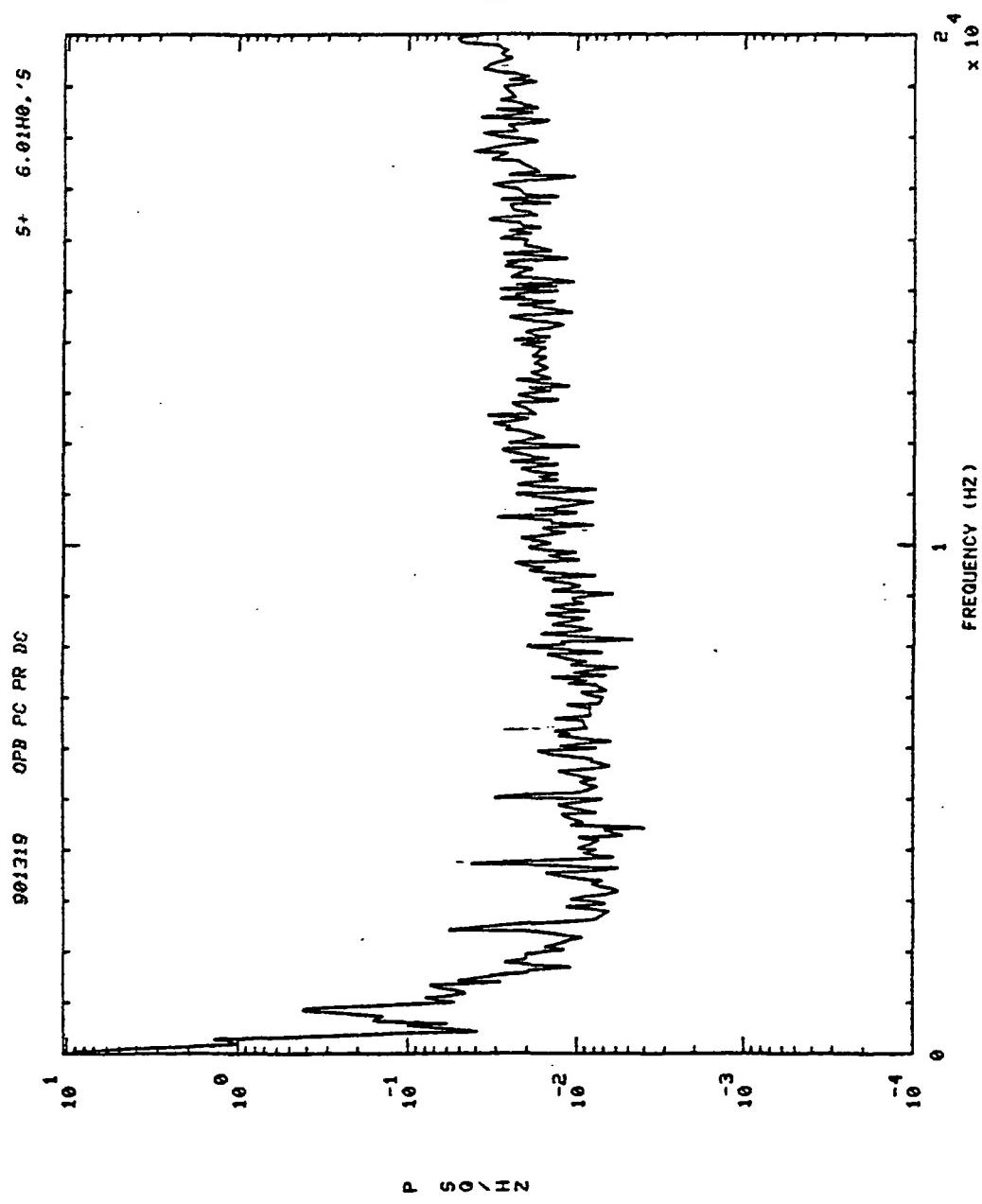




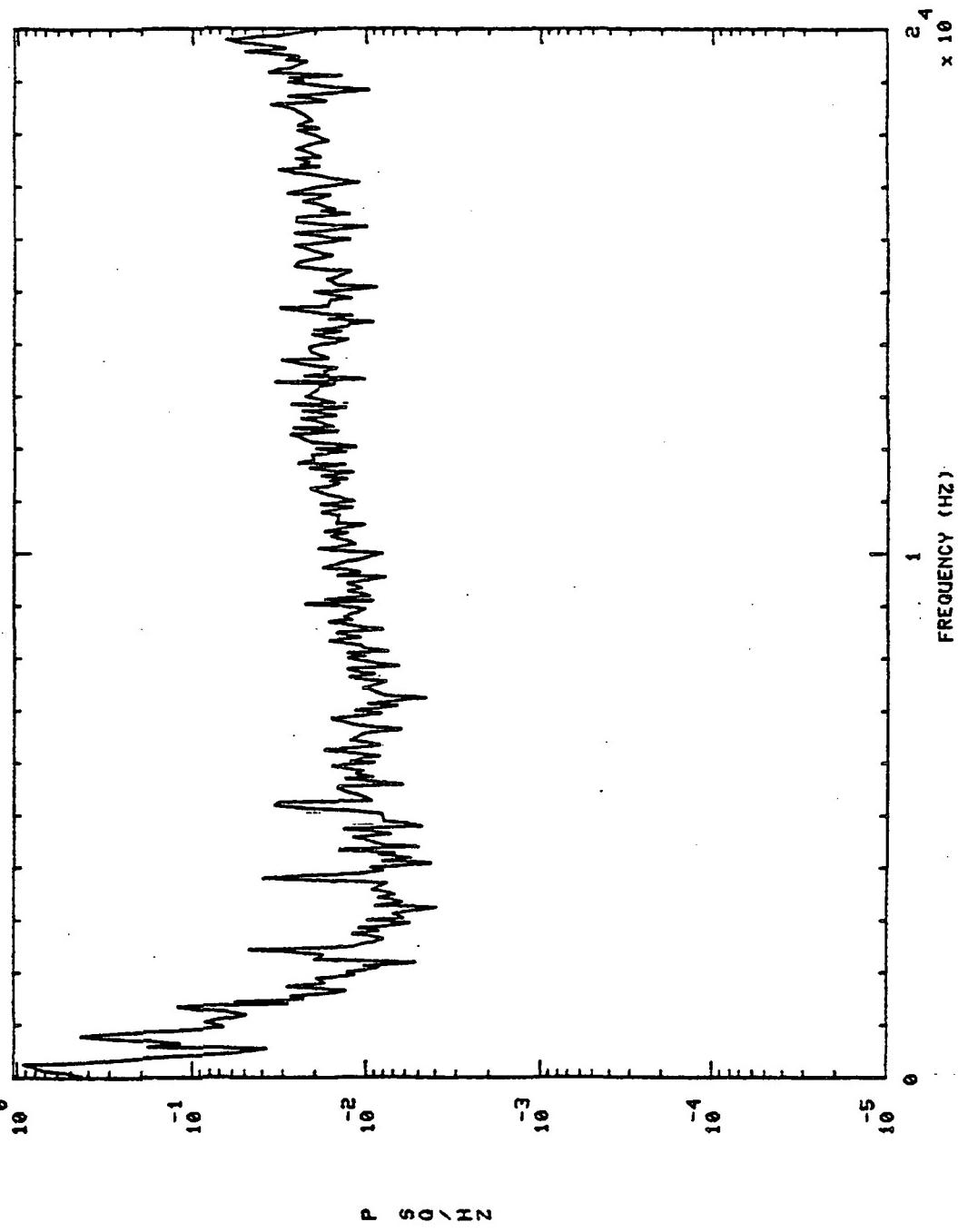
901319

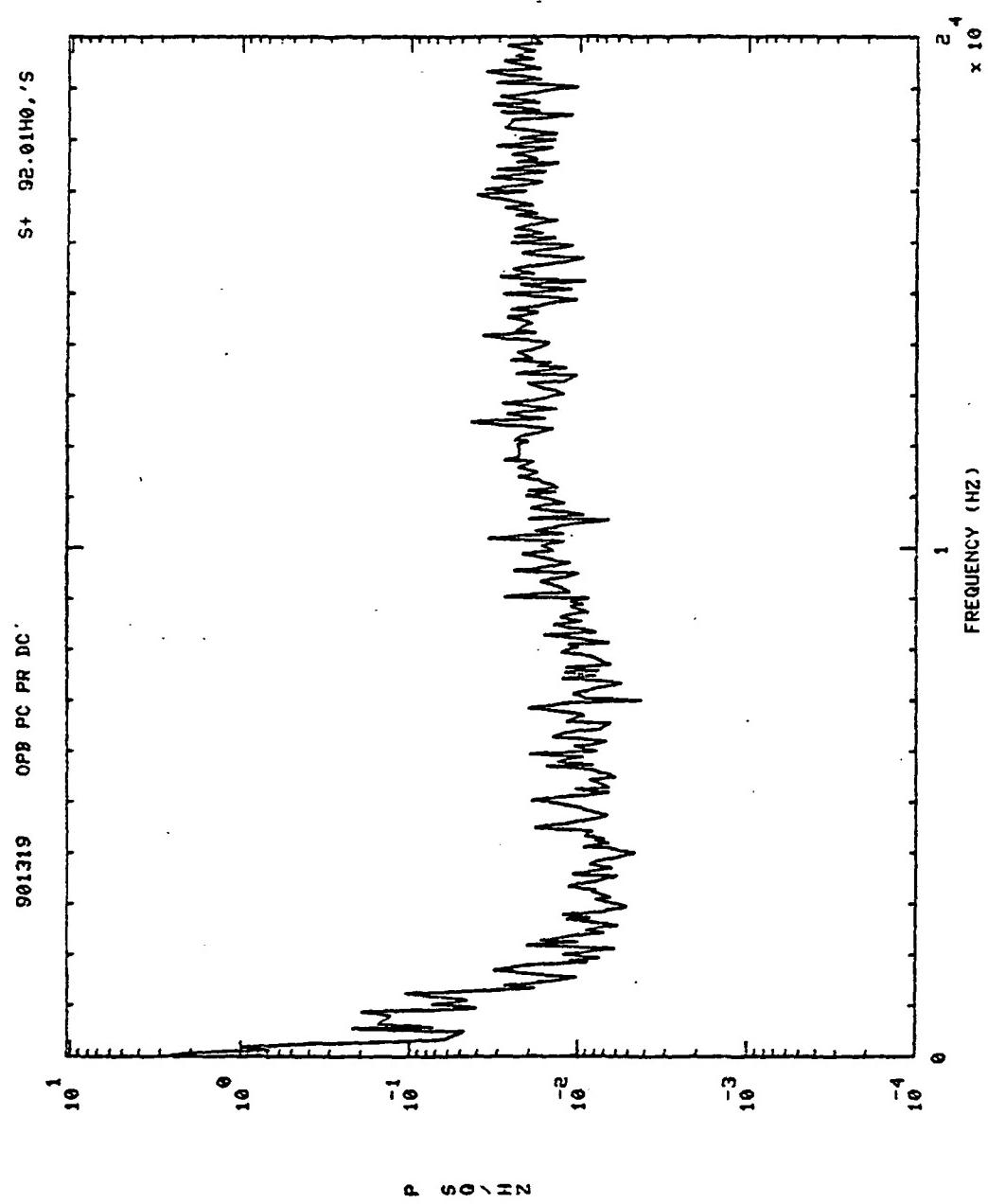
S+ 180.01H0.5





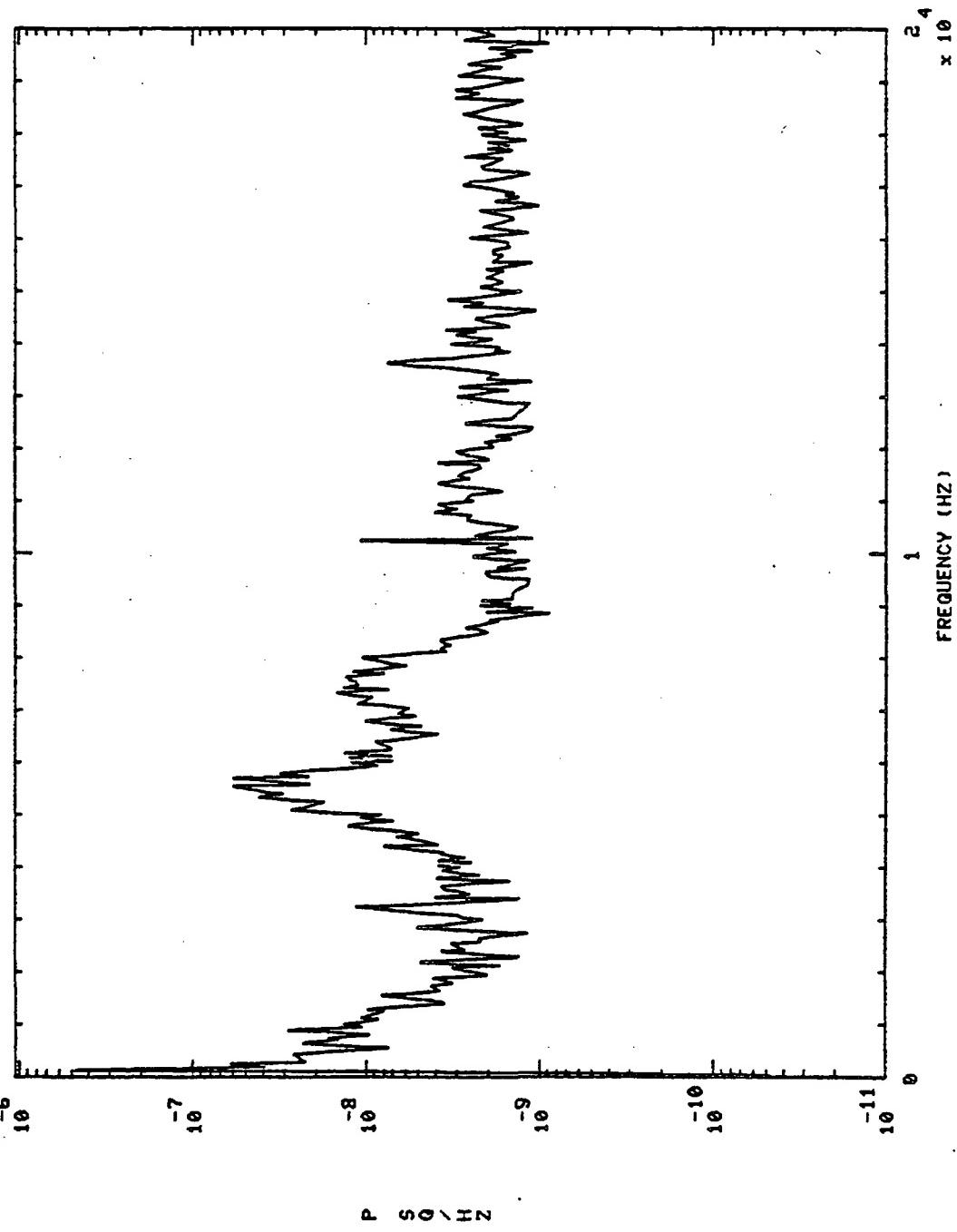
901319 0P8 PC PR DC 6+ 30.01Hz, 5

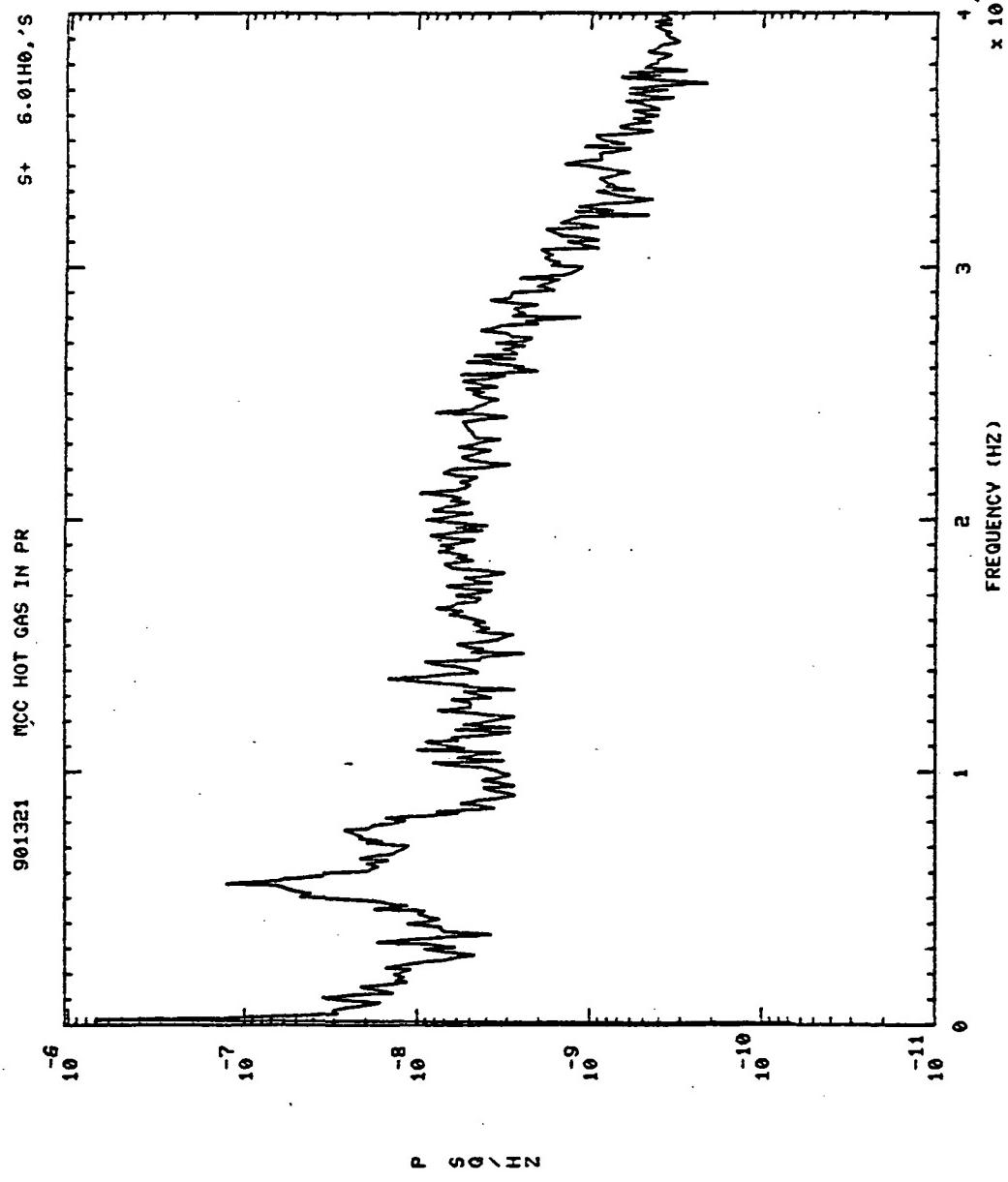




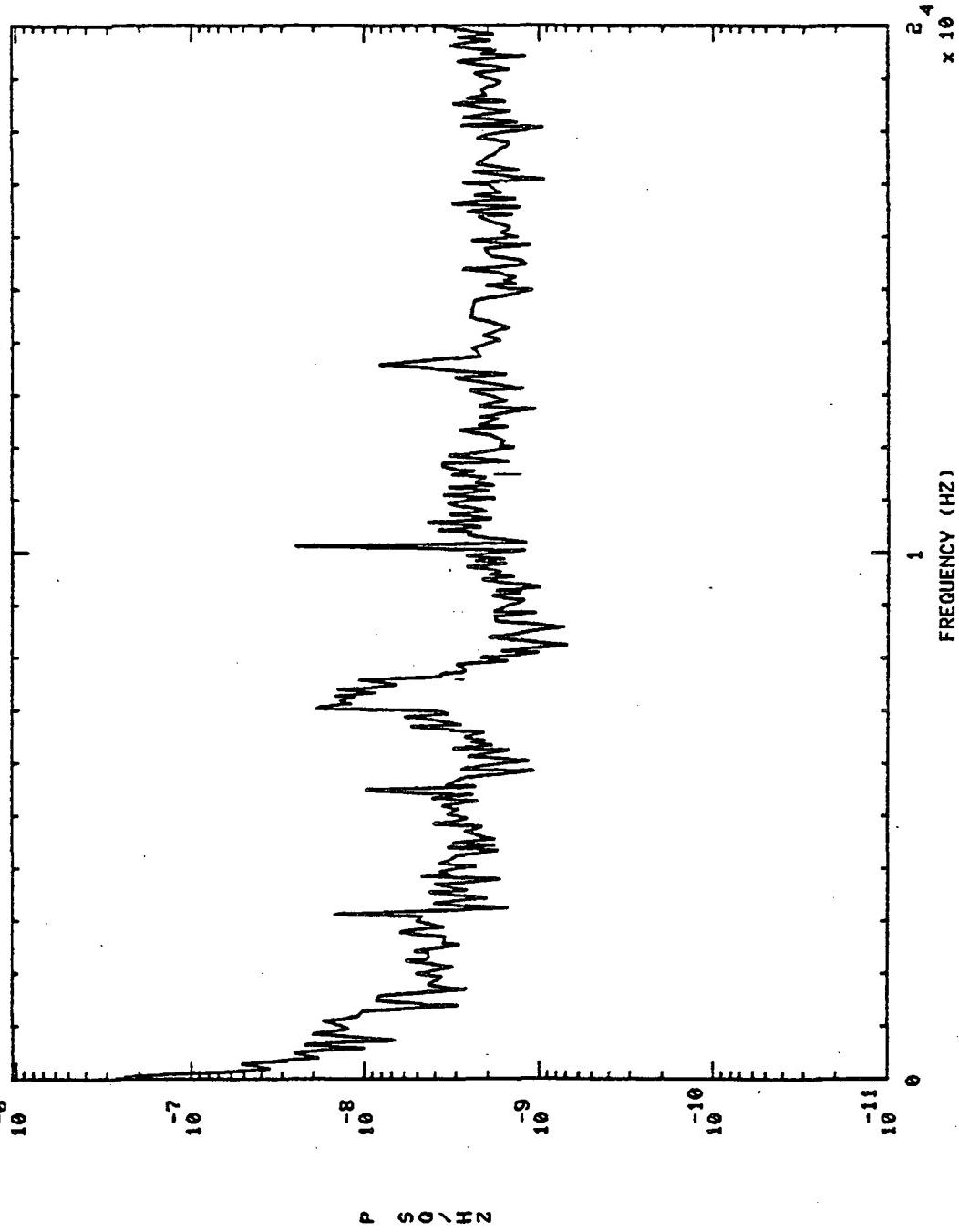
S+ 6.01H0.'S

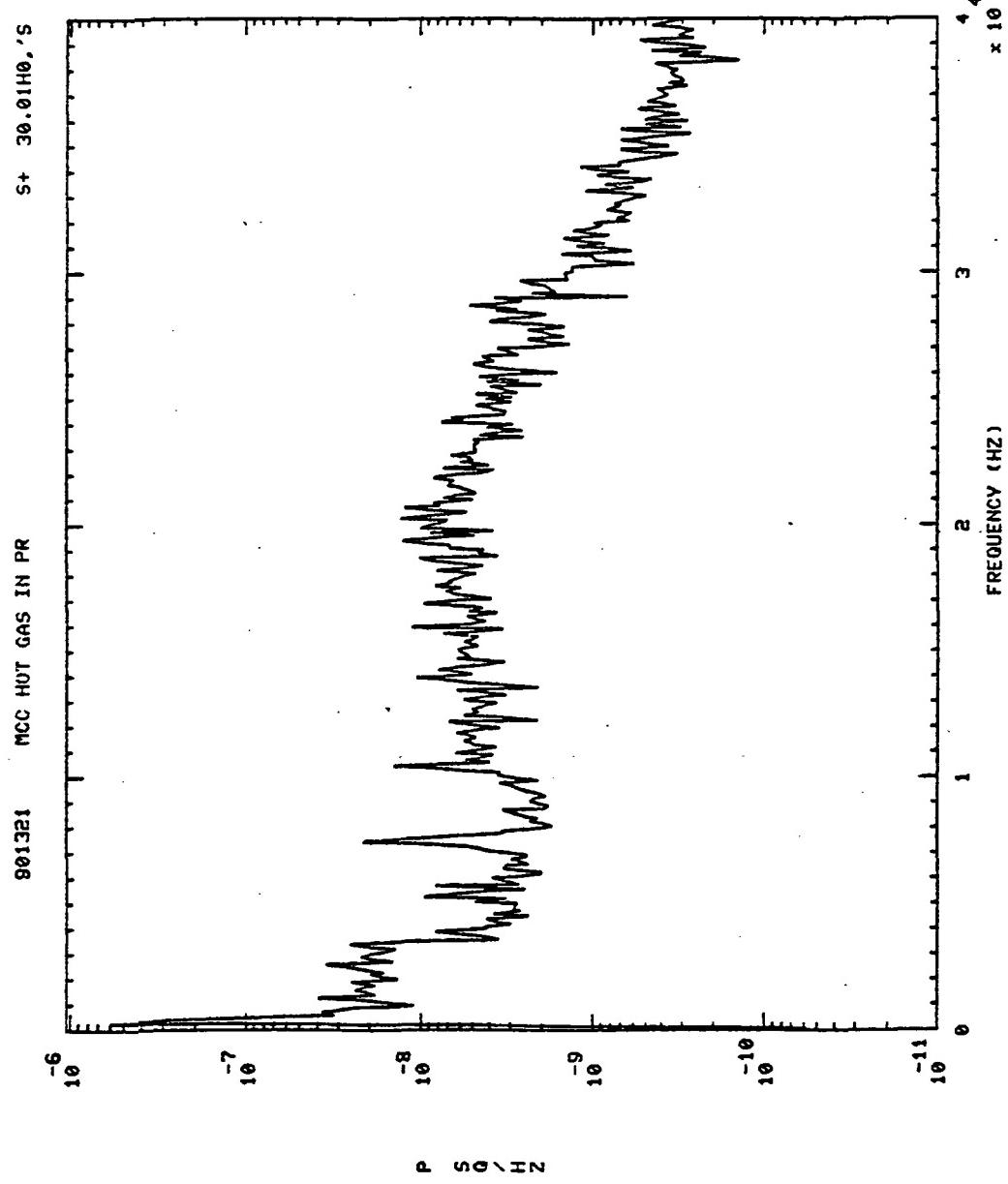
901321 MCC HOT GAS IN PR





S+ 30.01H0, 'S
901321 MCC HOT GAS IN PR

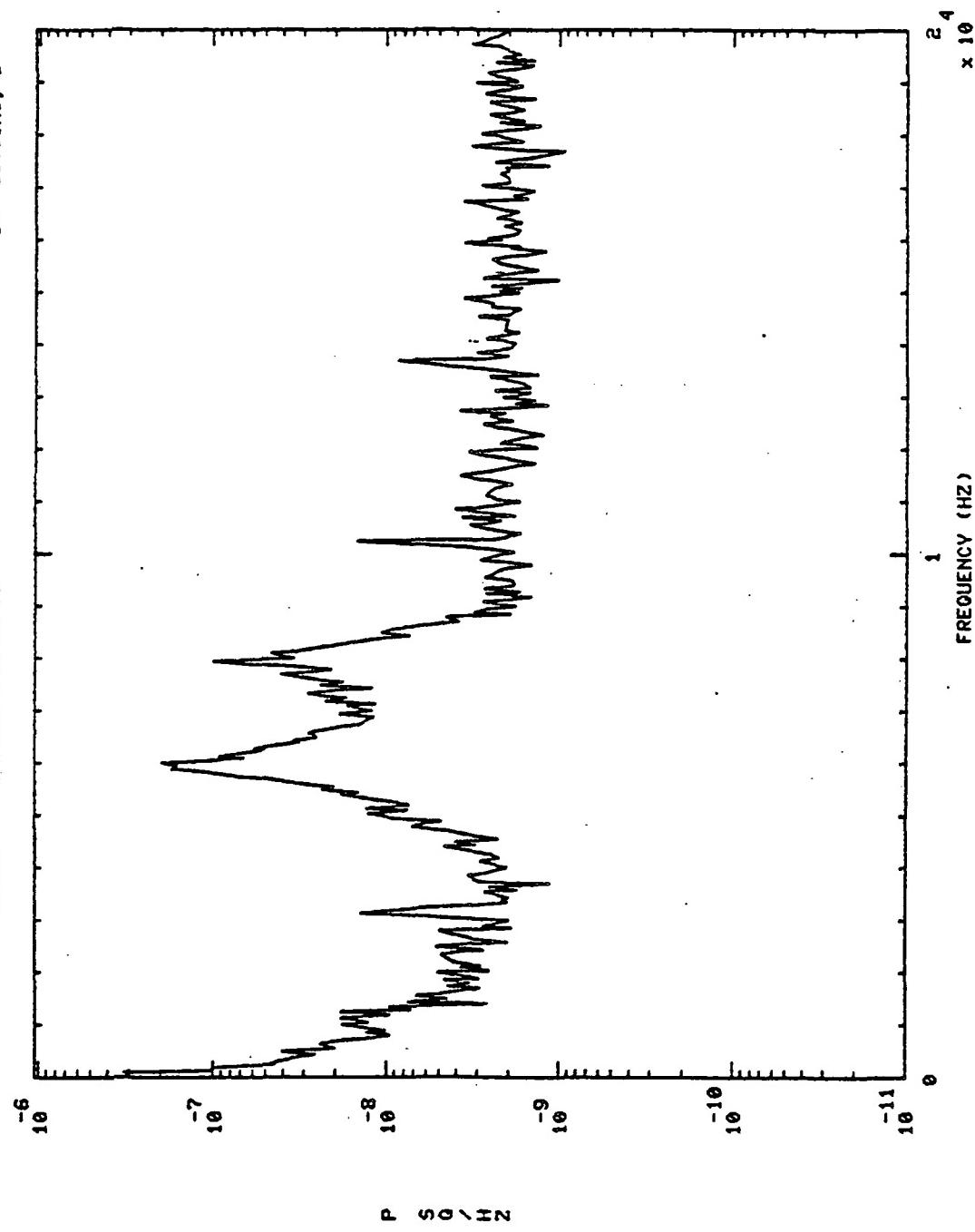


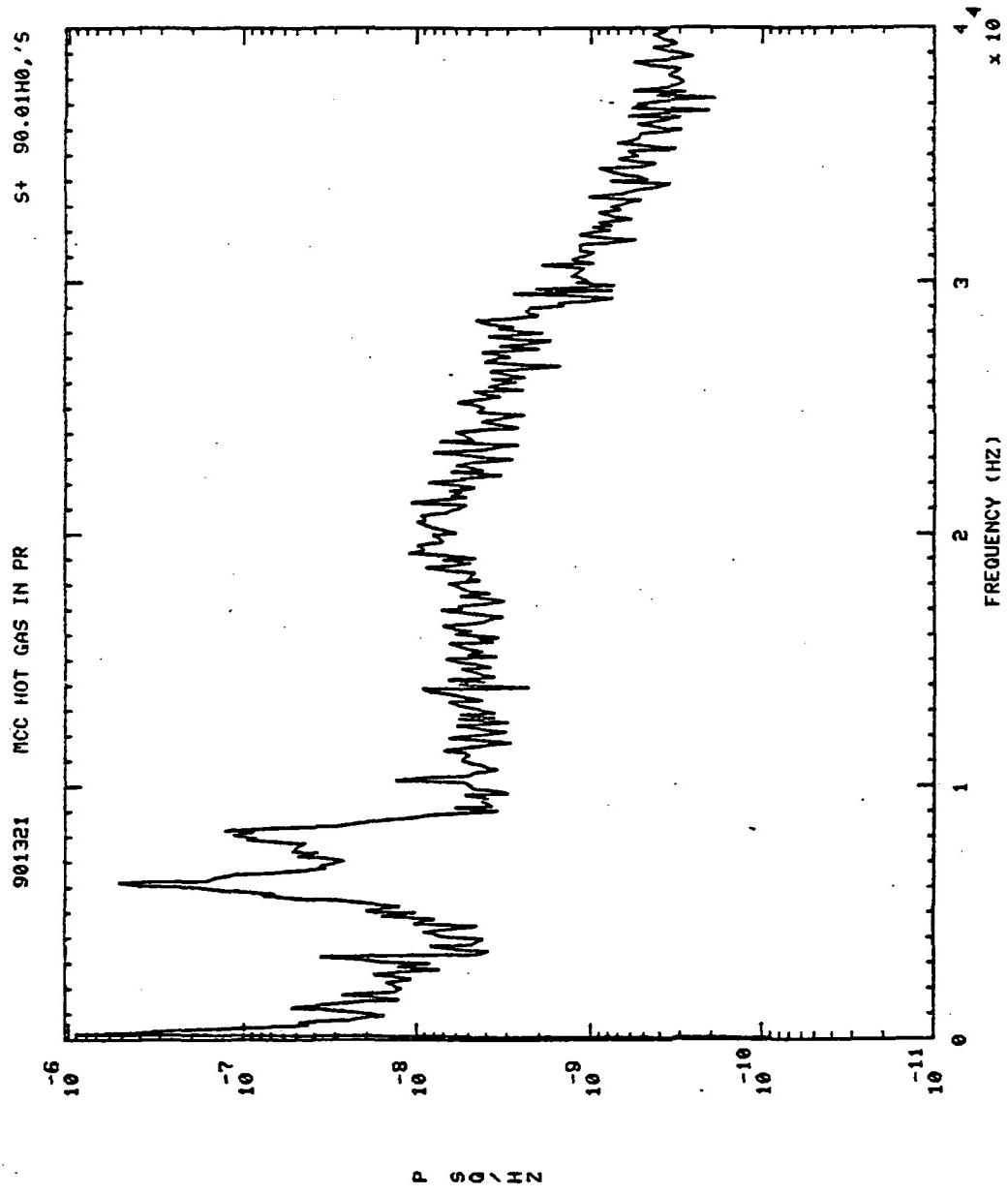


S+ 90.01Hz, 'S'

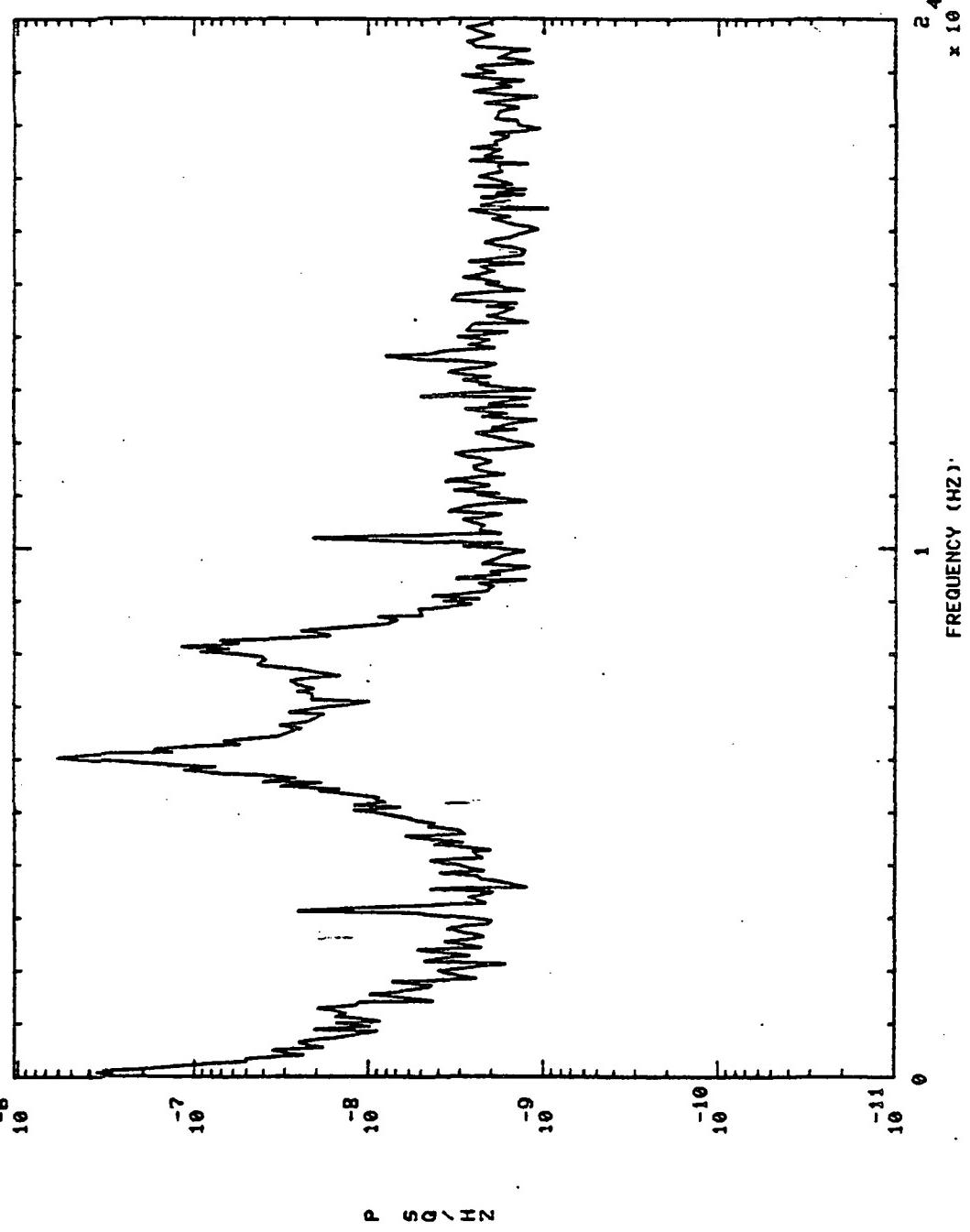
901321 MCC HOT GAS IN PR

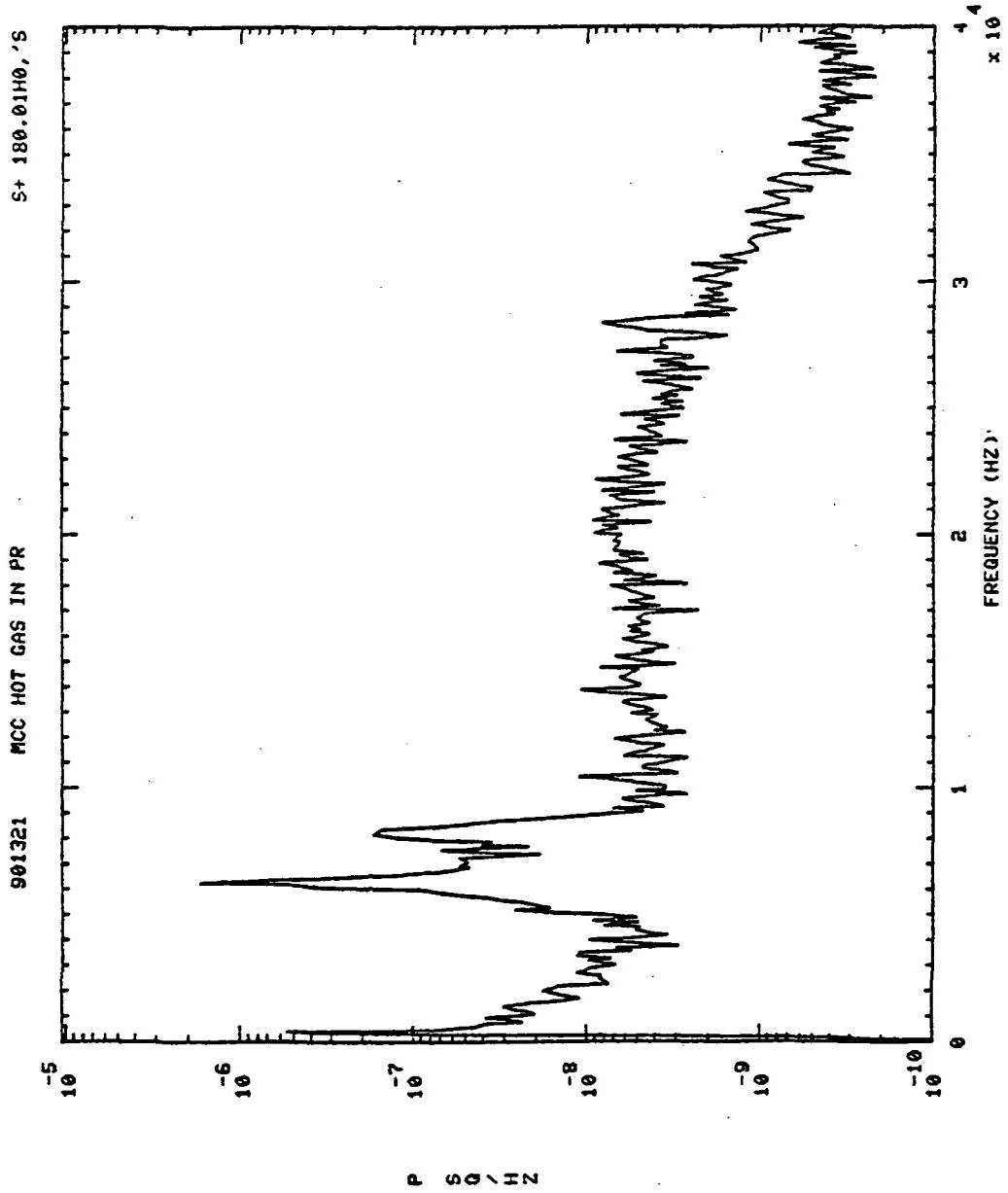
901321



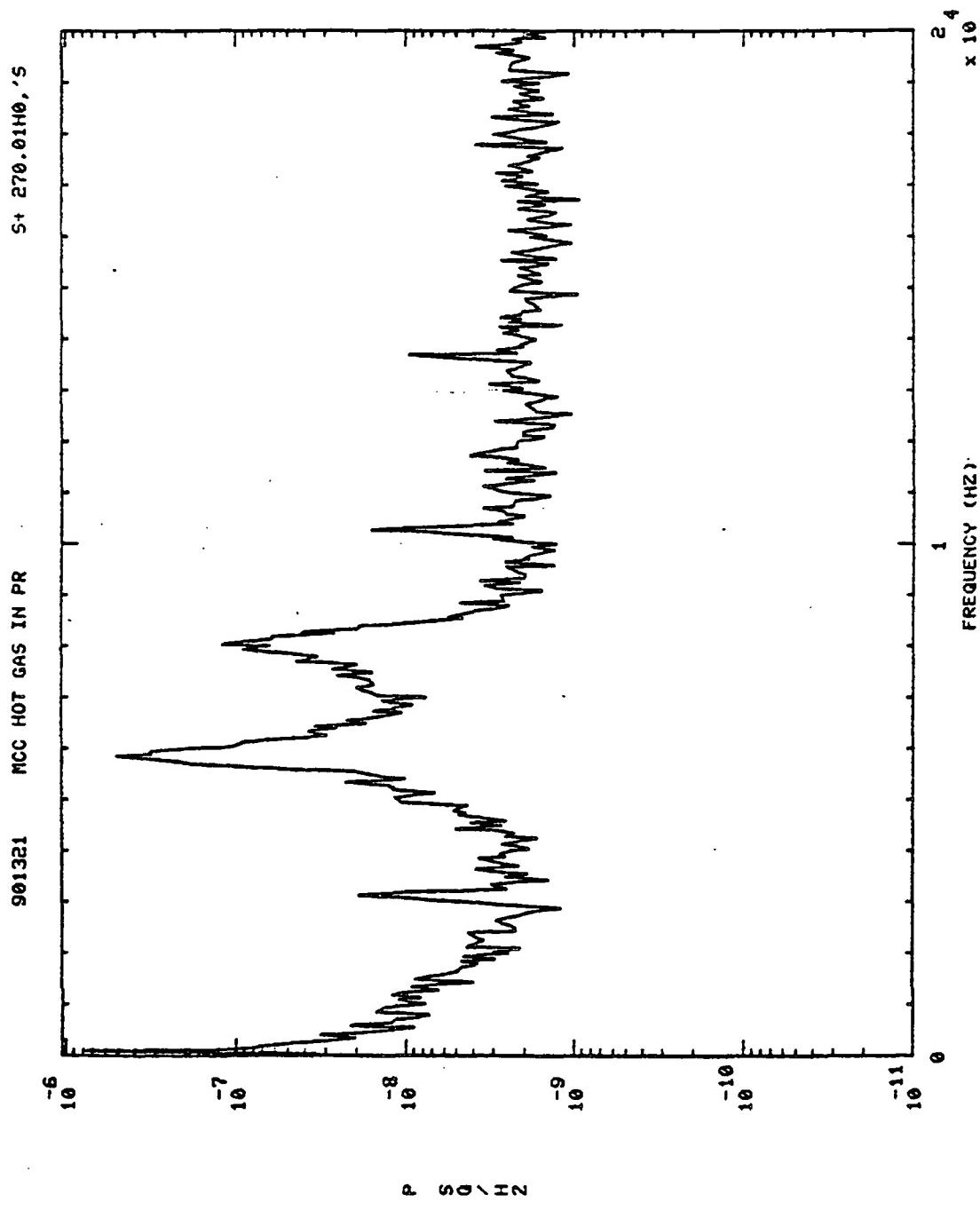


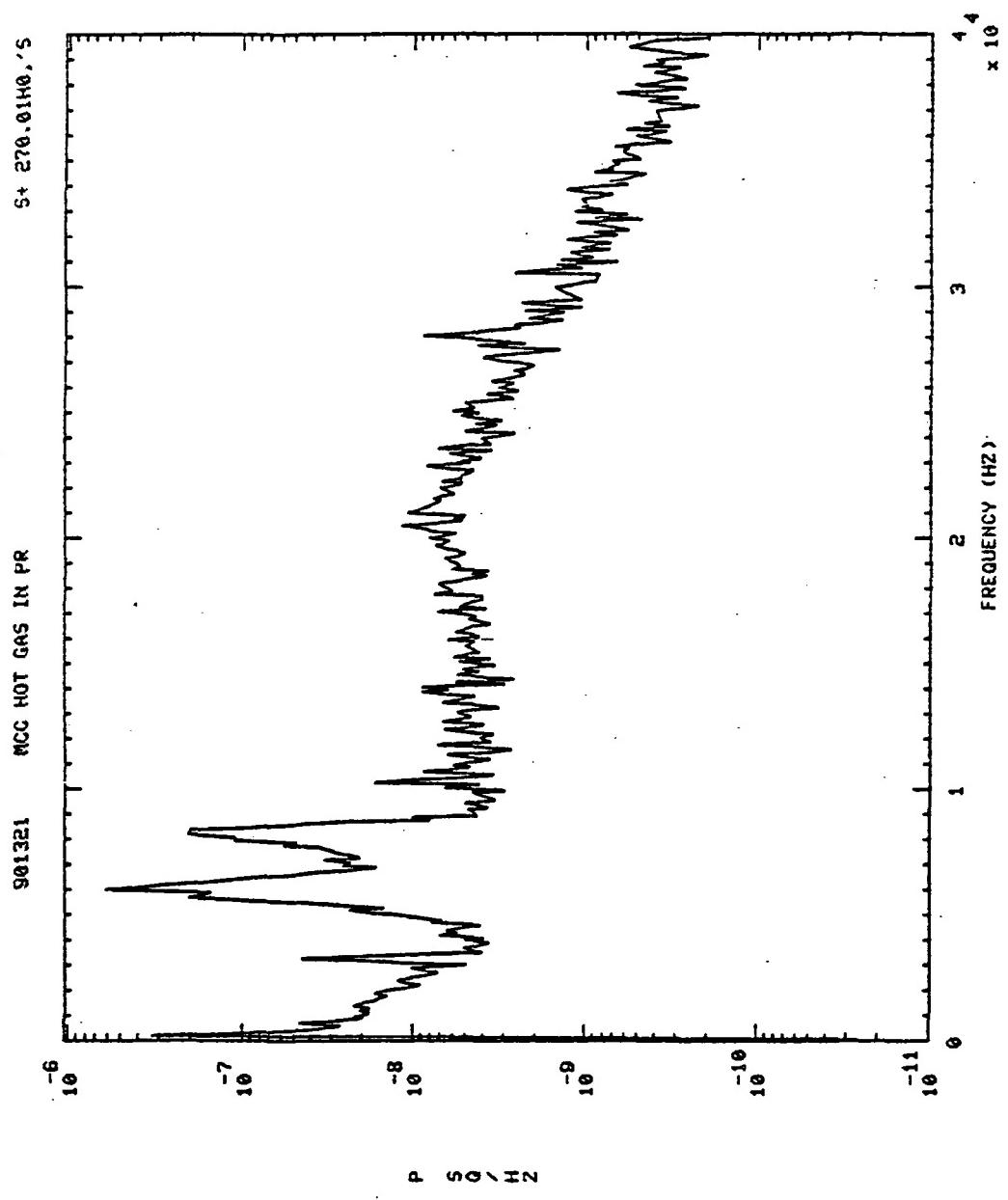
901321 MCC HOT GAS IN PR
S+ 100.01H0, 5





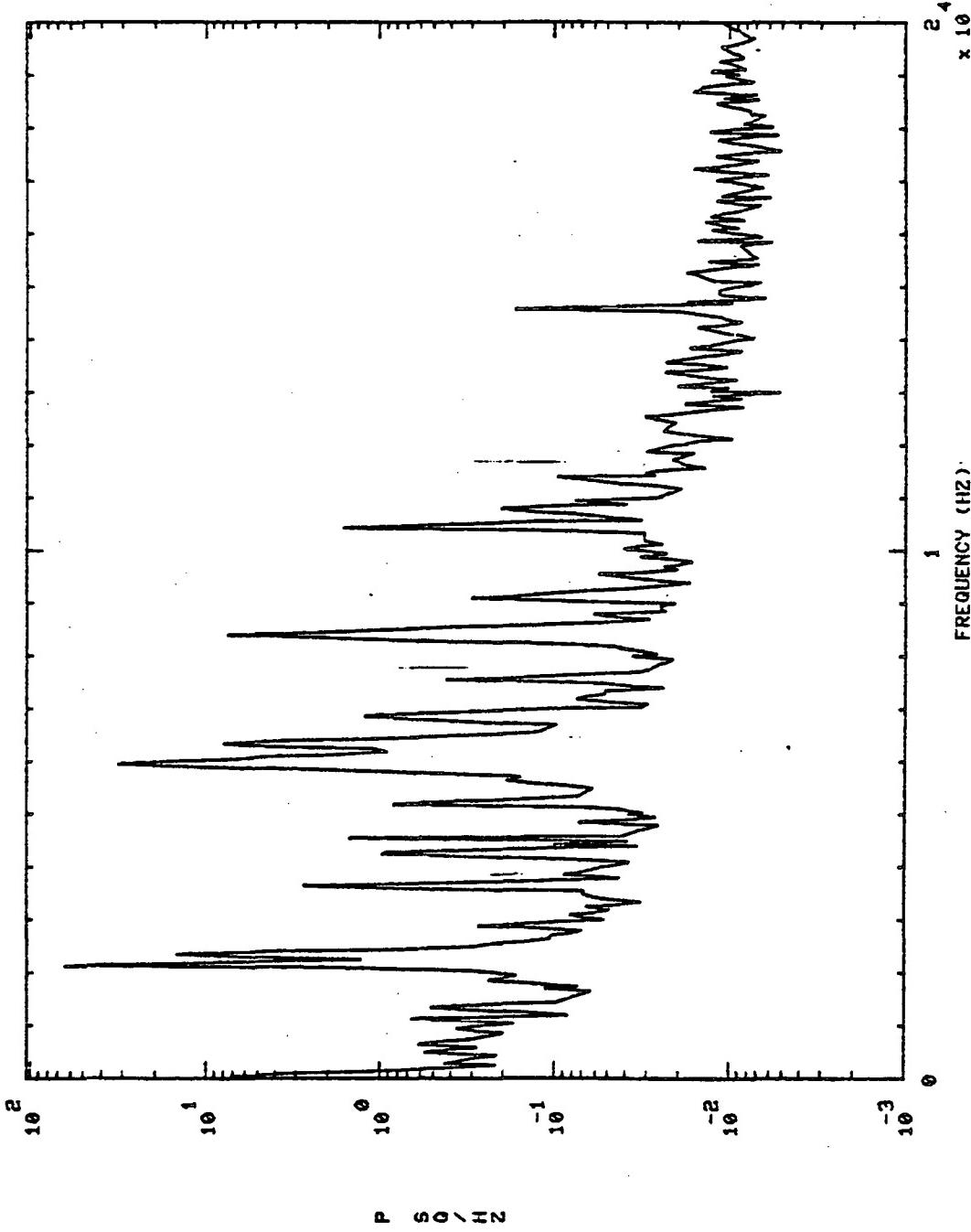
901321 MCC HOT GAS IN PR

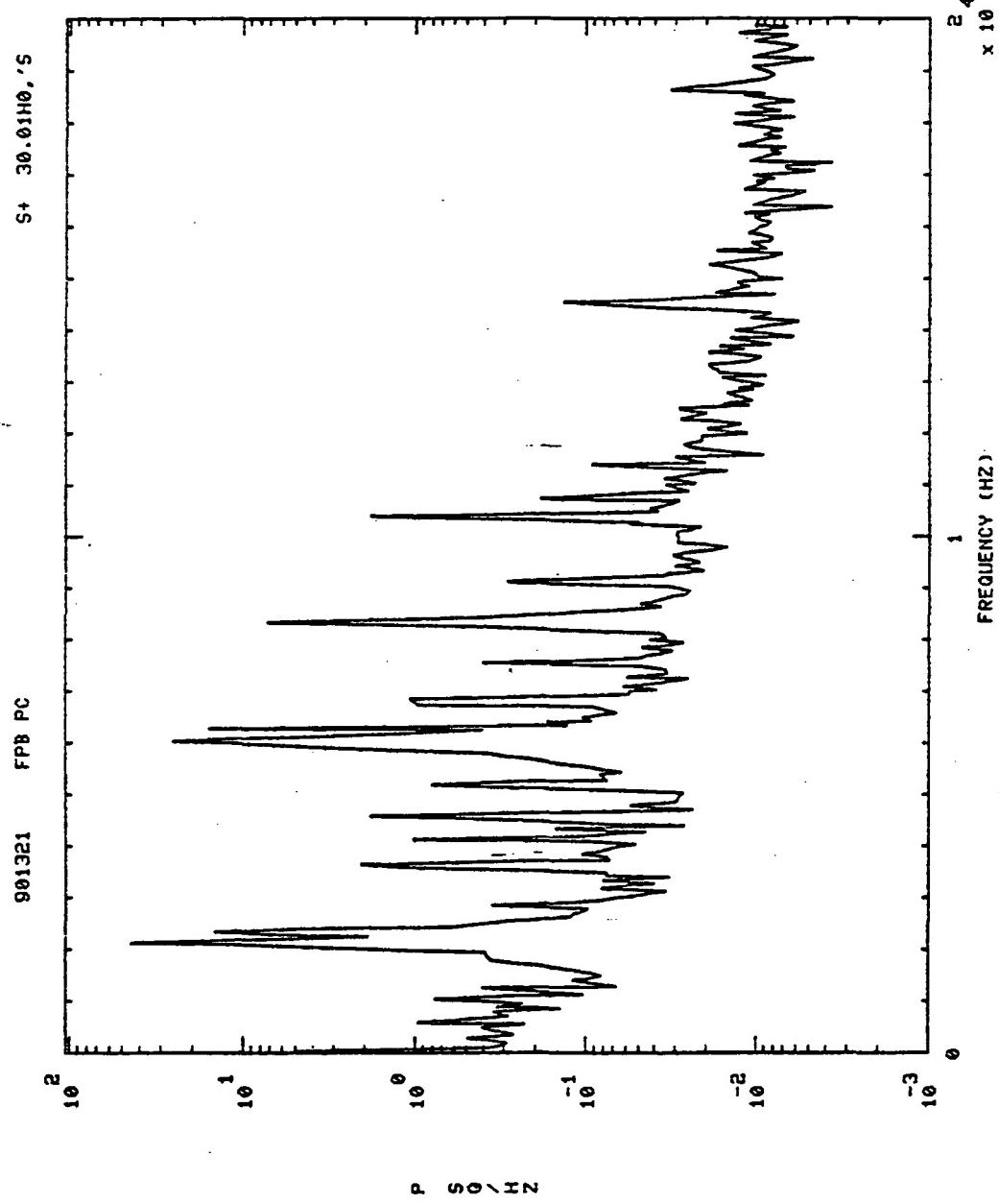




S+ 6.0140, 5

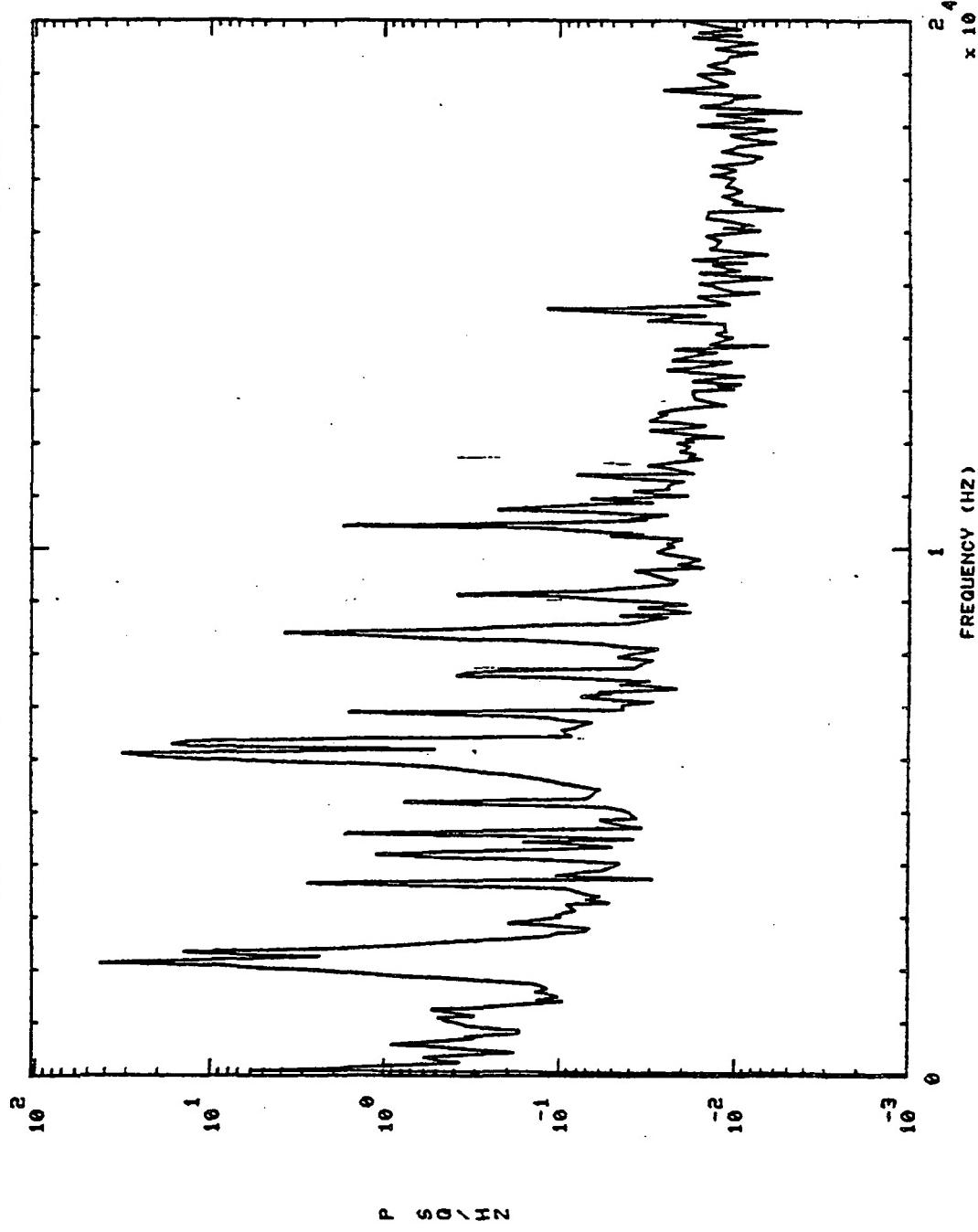
901321 FPB PC

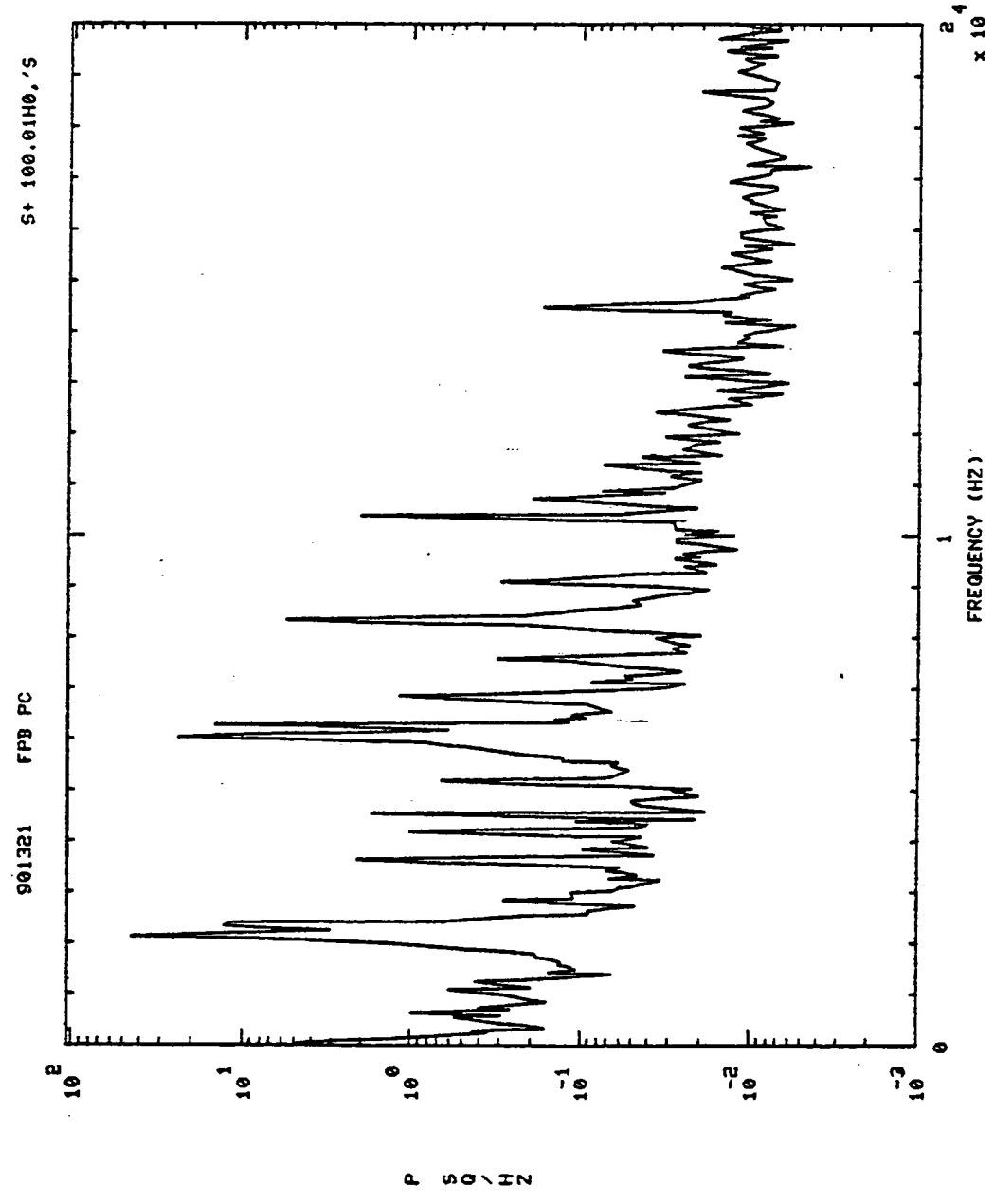




S+ 90.01H0.'S

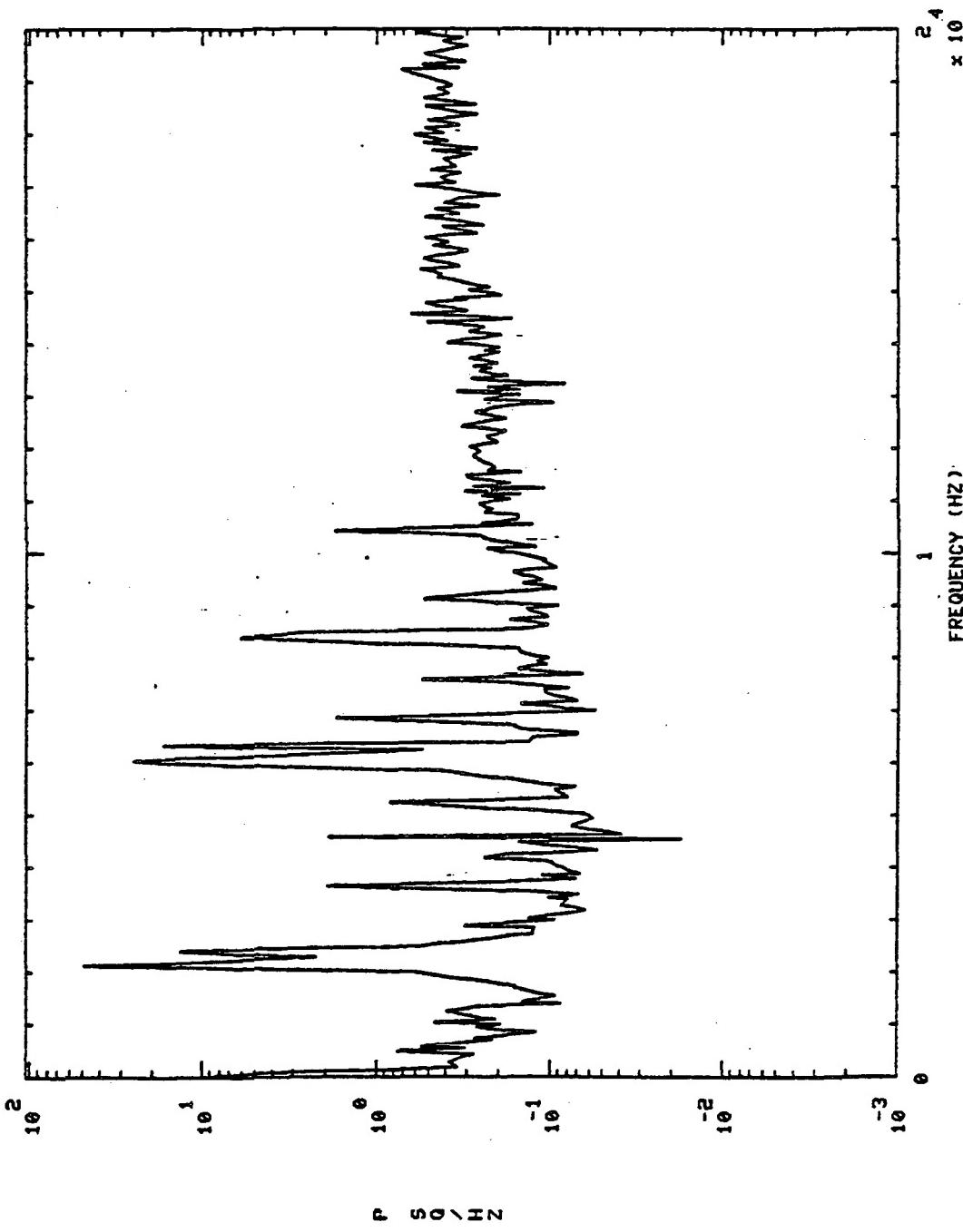
901321 FPB PC

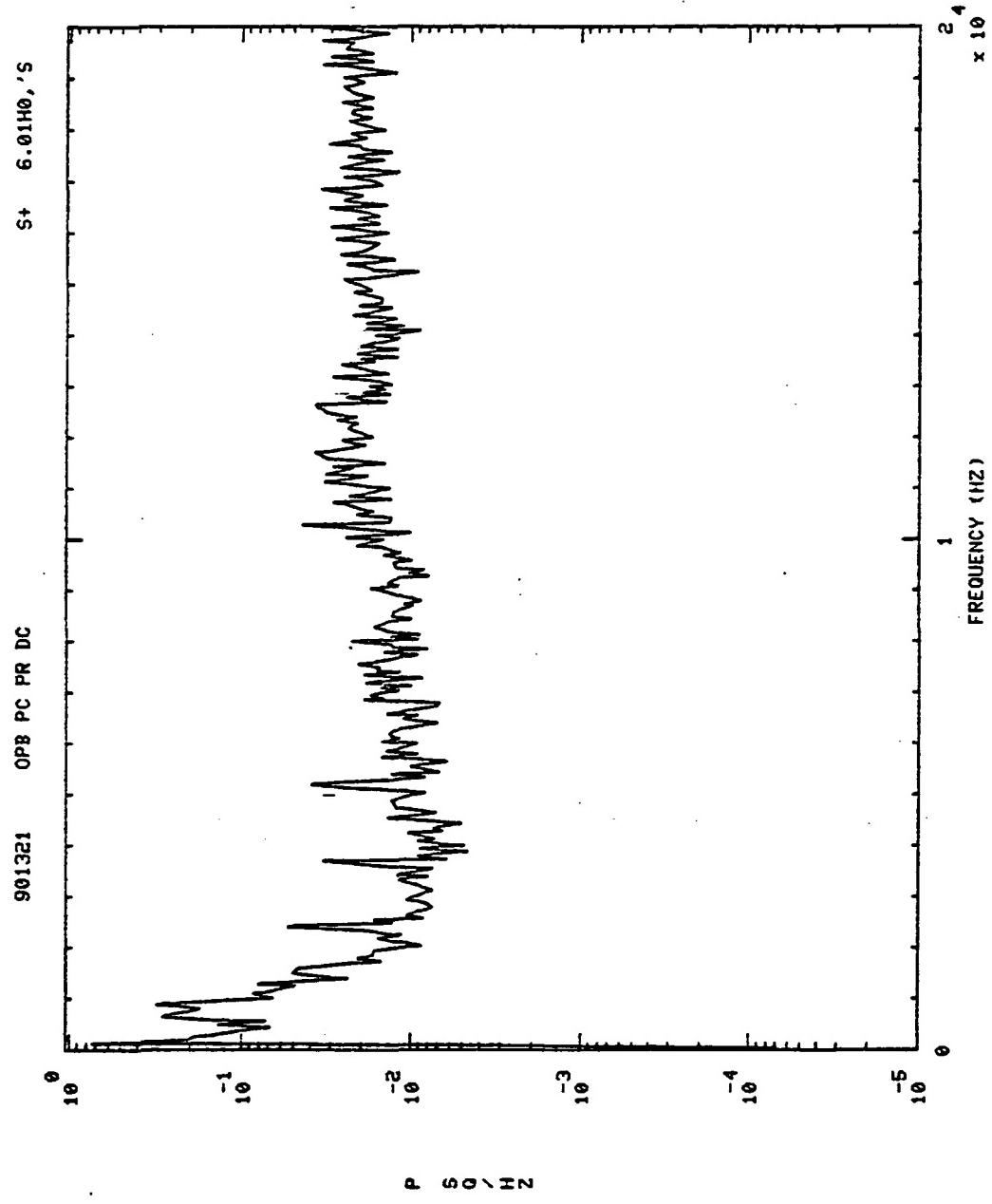




S+ 270.01H0.'S

901321 FPPB PC

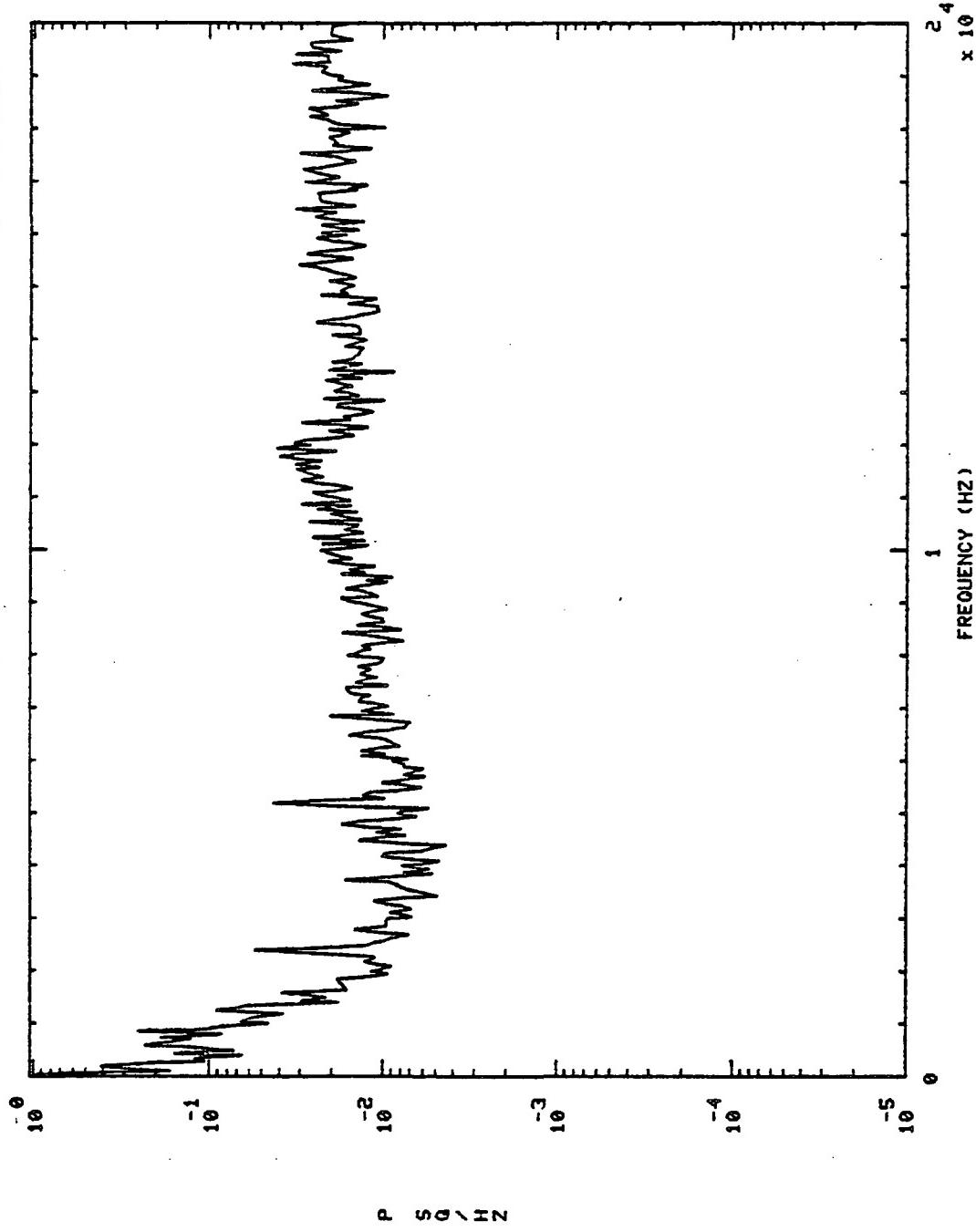


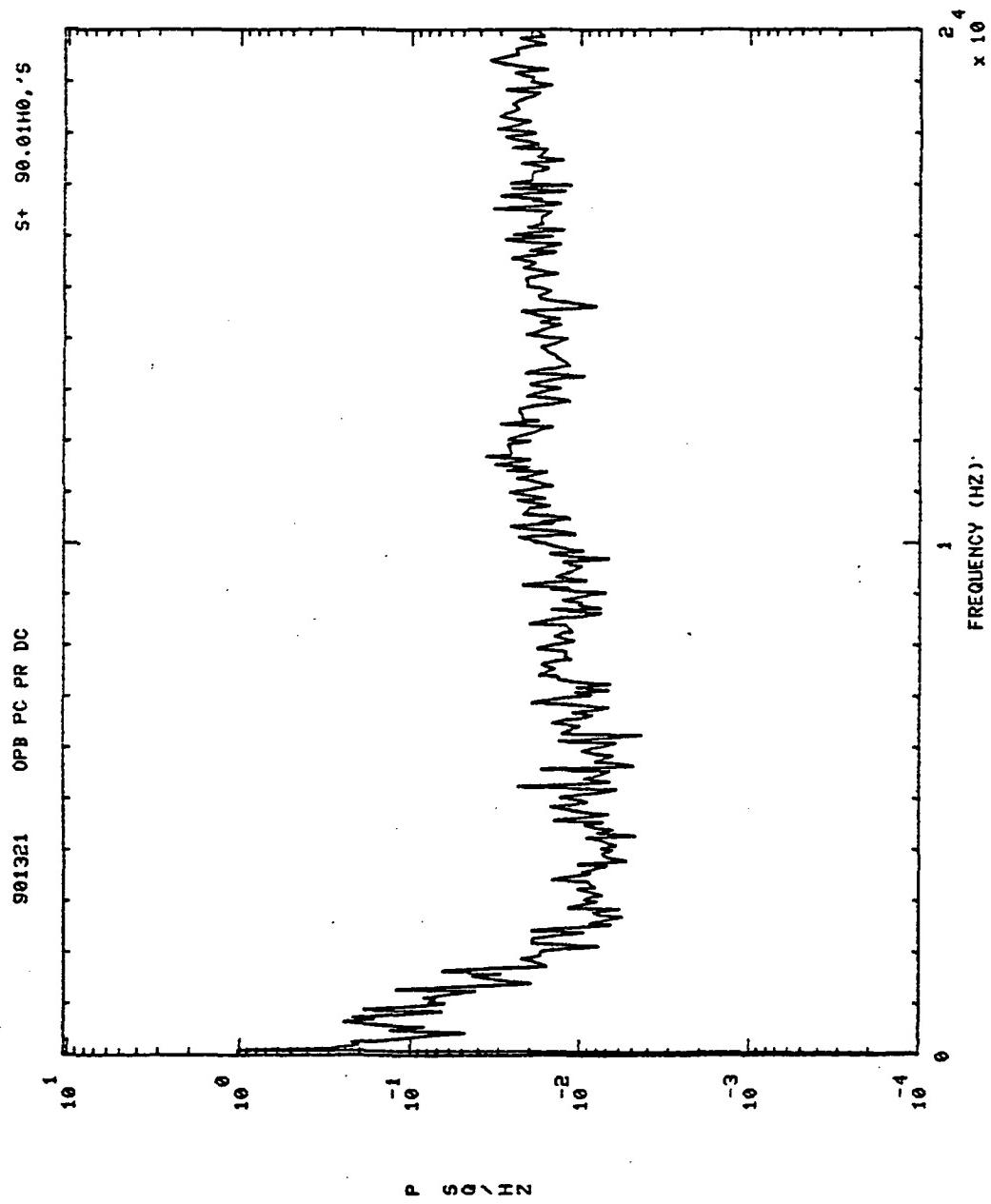


5+ 30.01H0, 'S

OPB PC PR DC

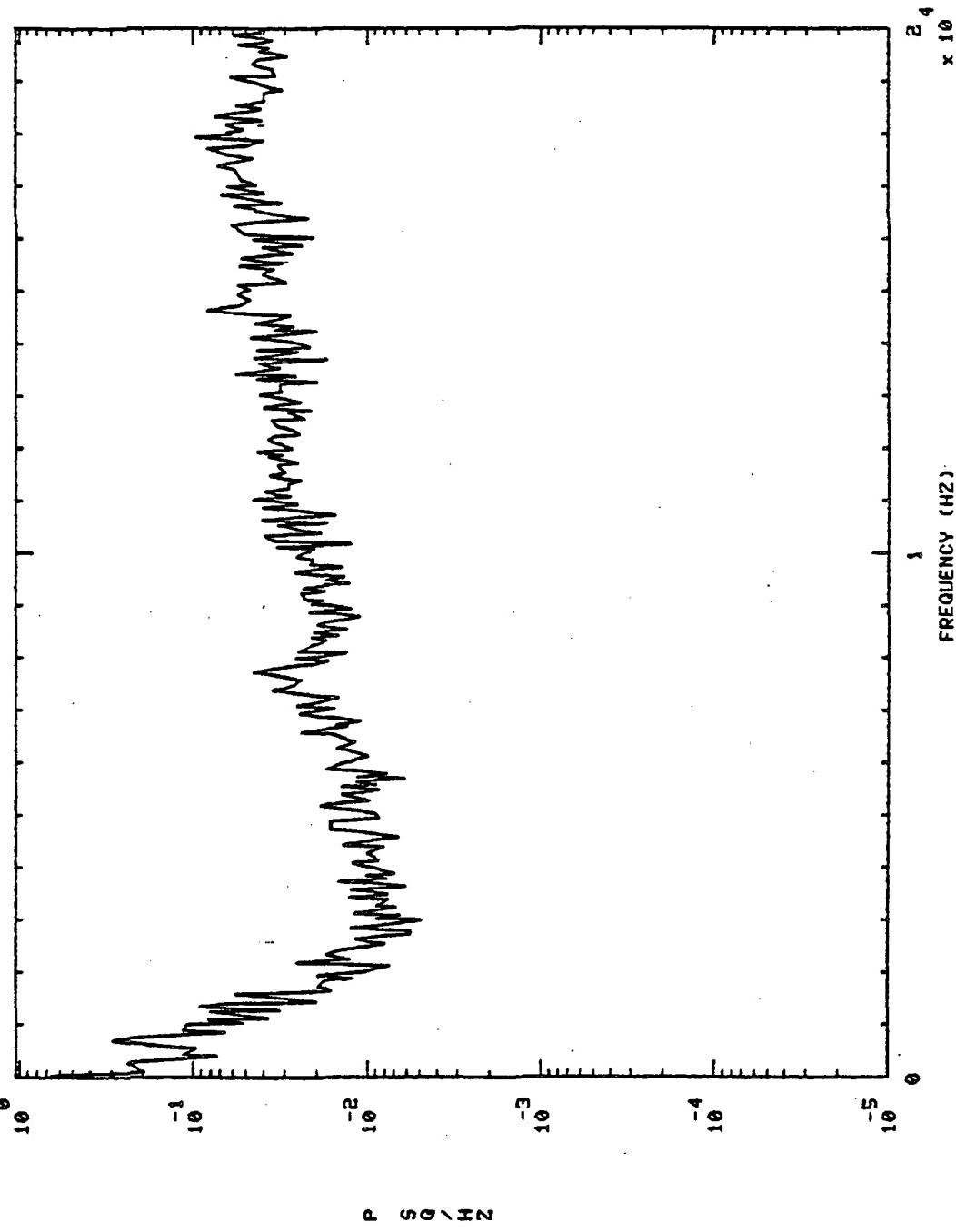
901321

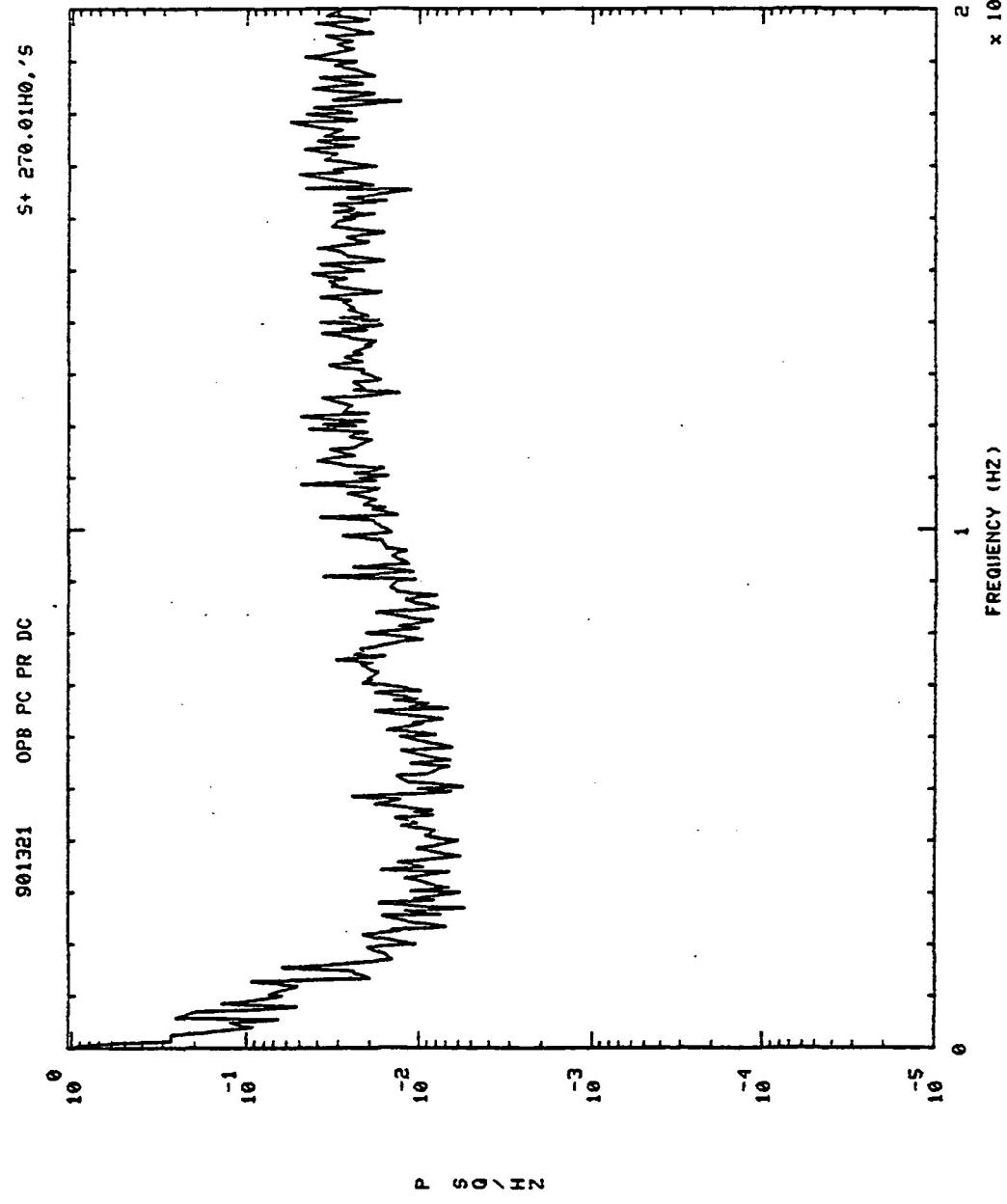


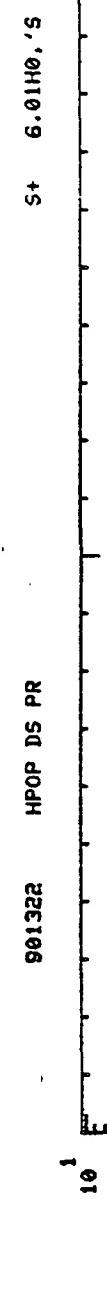


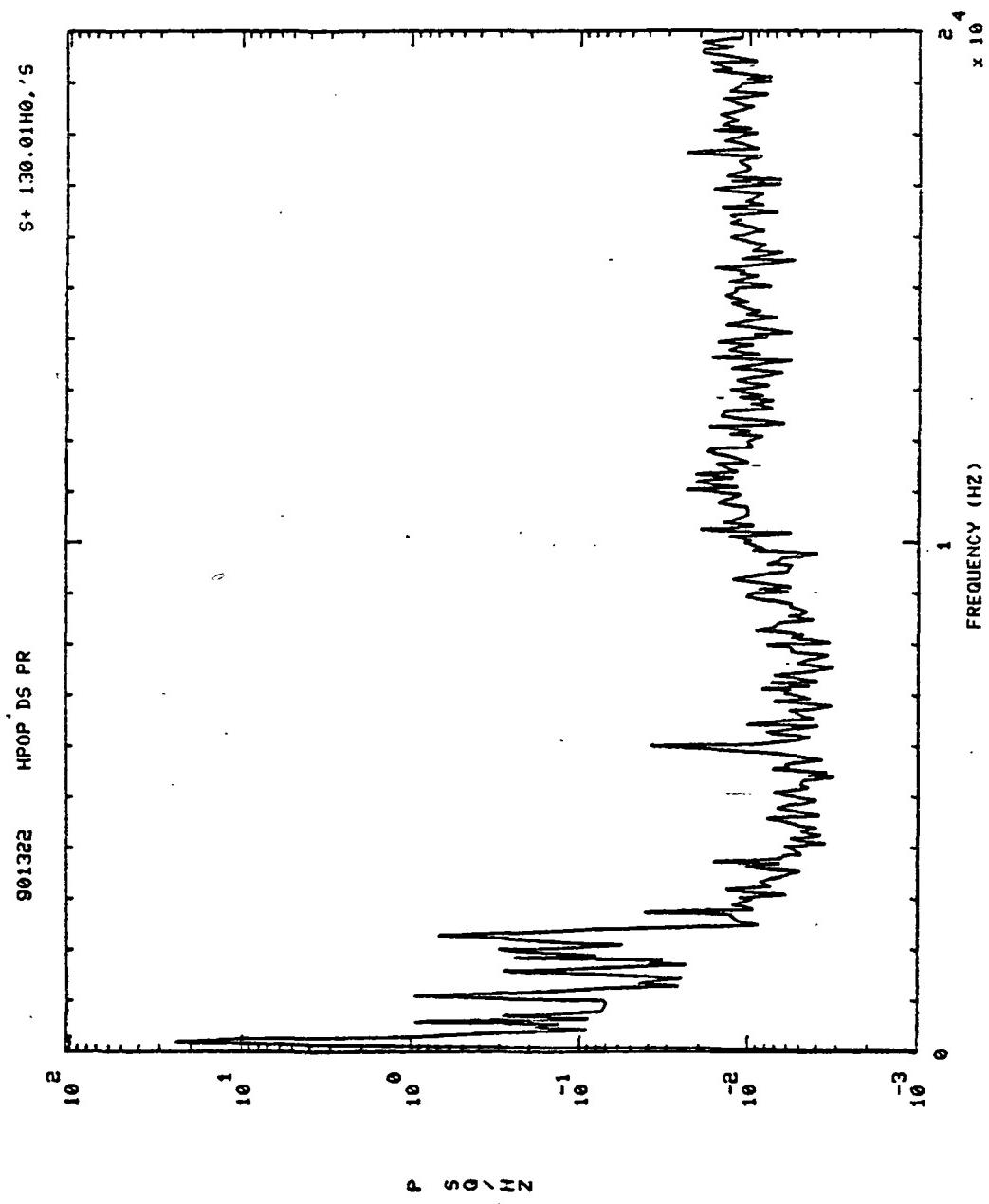
S+ 100.01Hz, 'S

901321 OFB PC PR DC





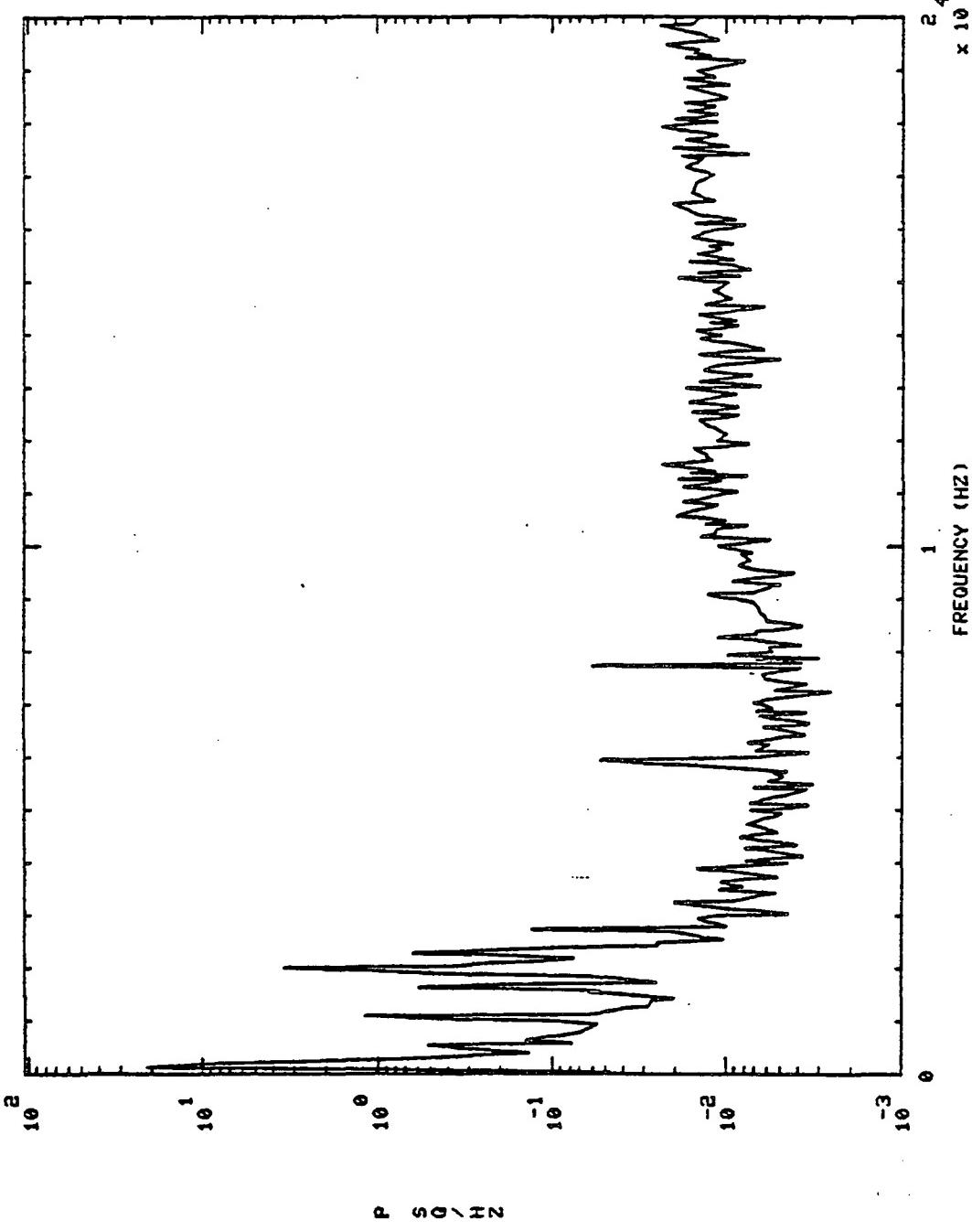




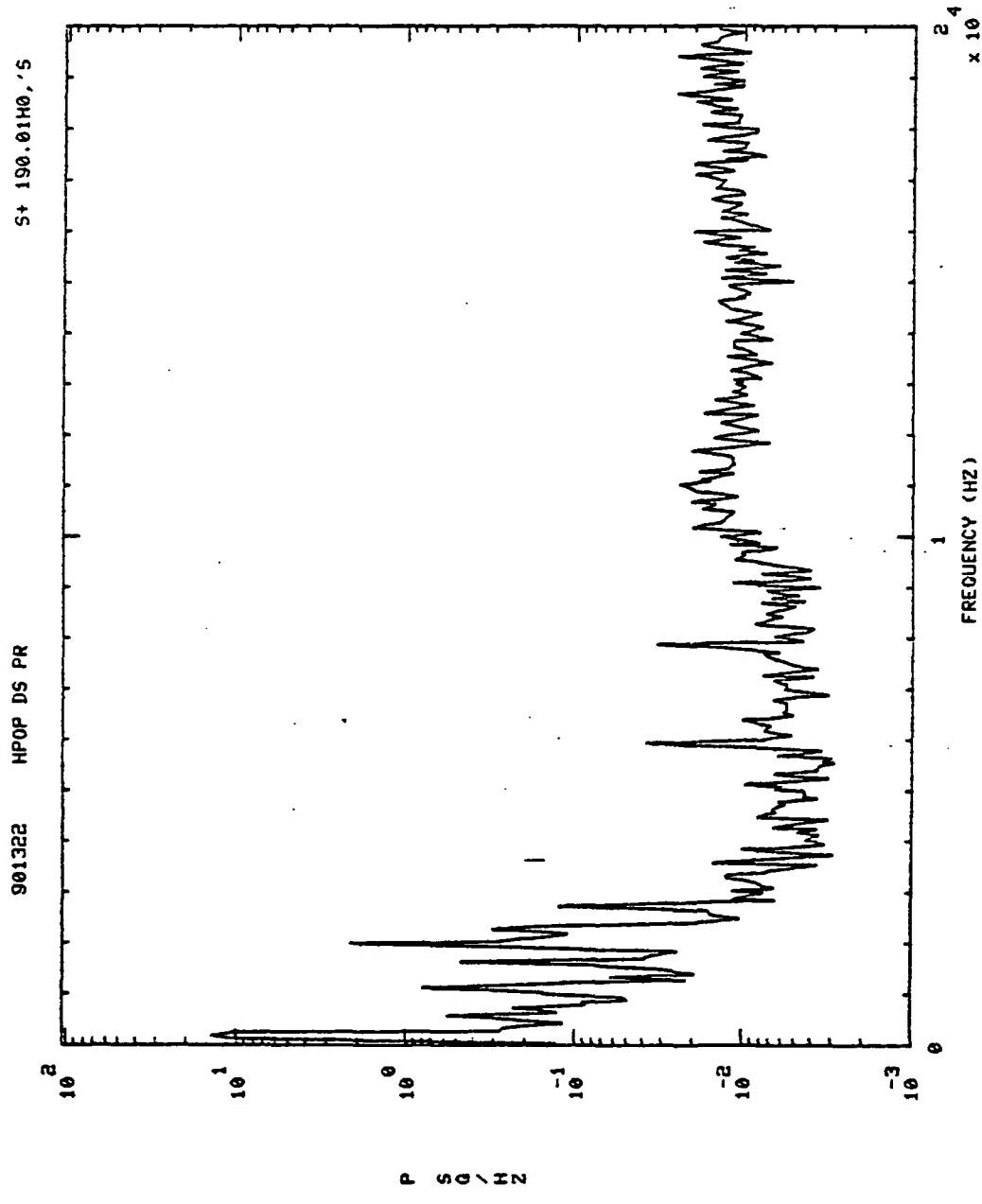
S+ 170.01H0.'S

HPOP DS PR

901322



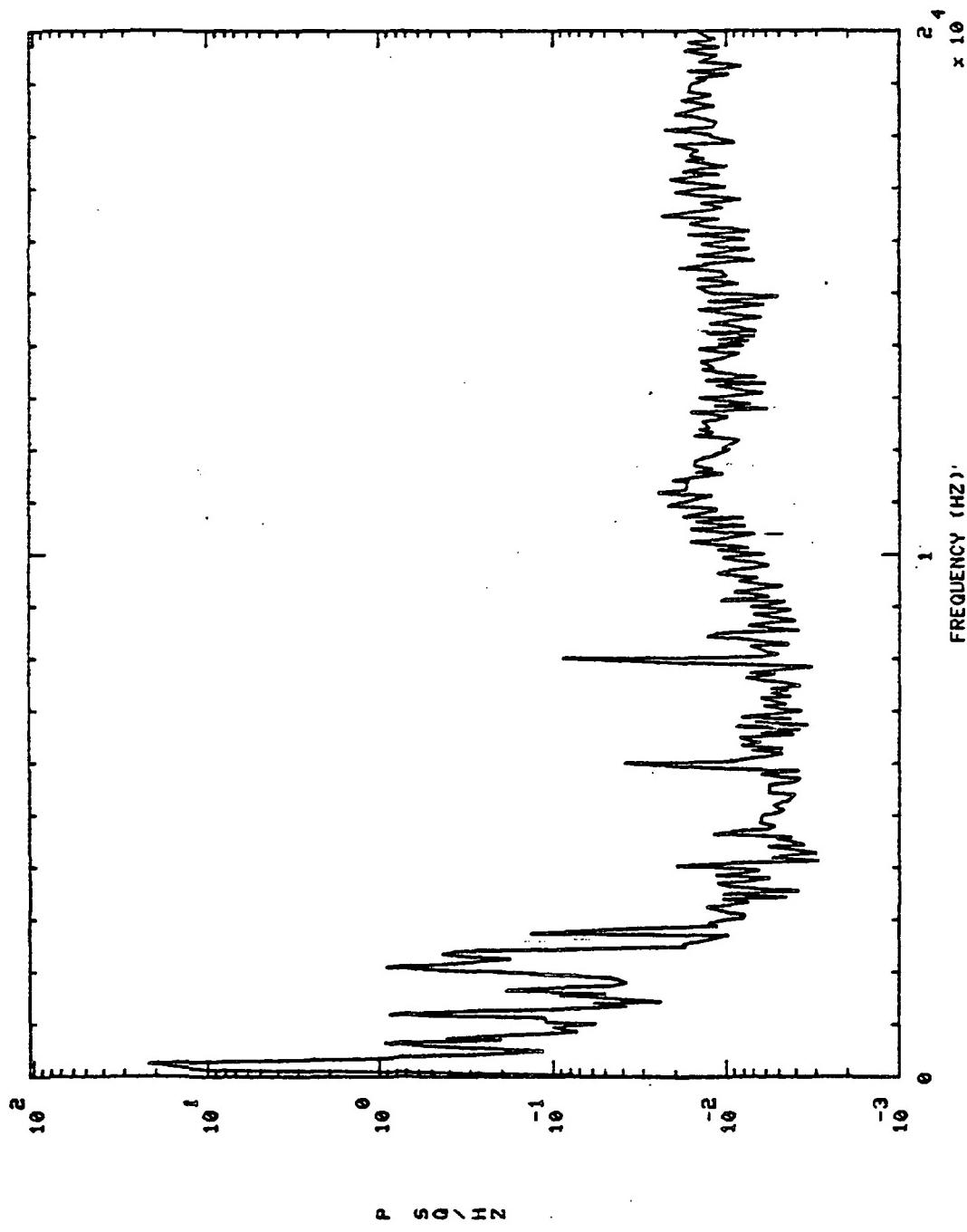
P S Q / HZ

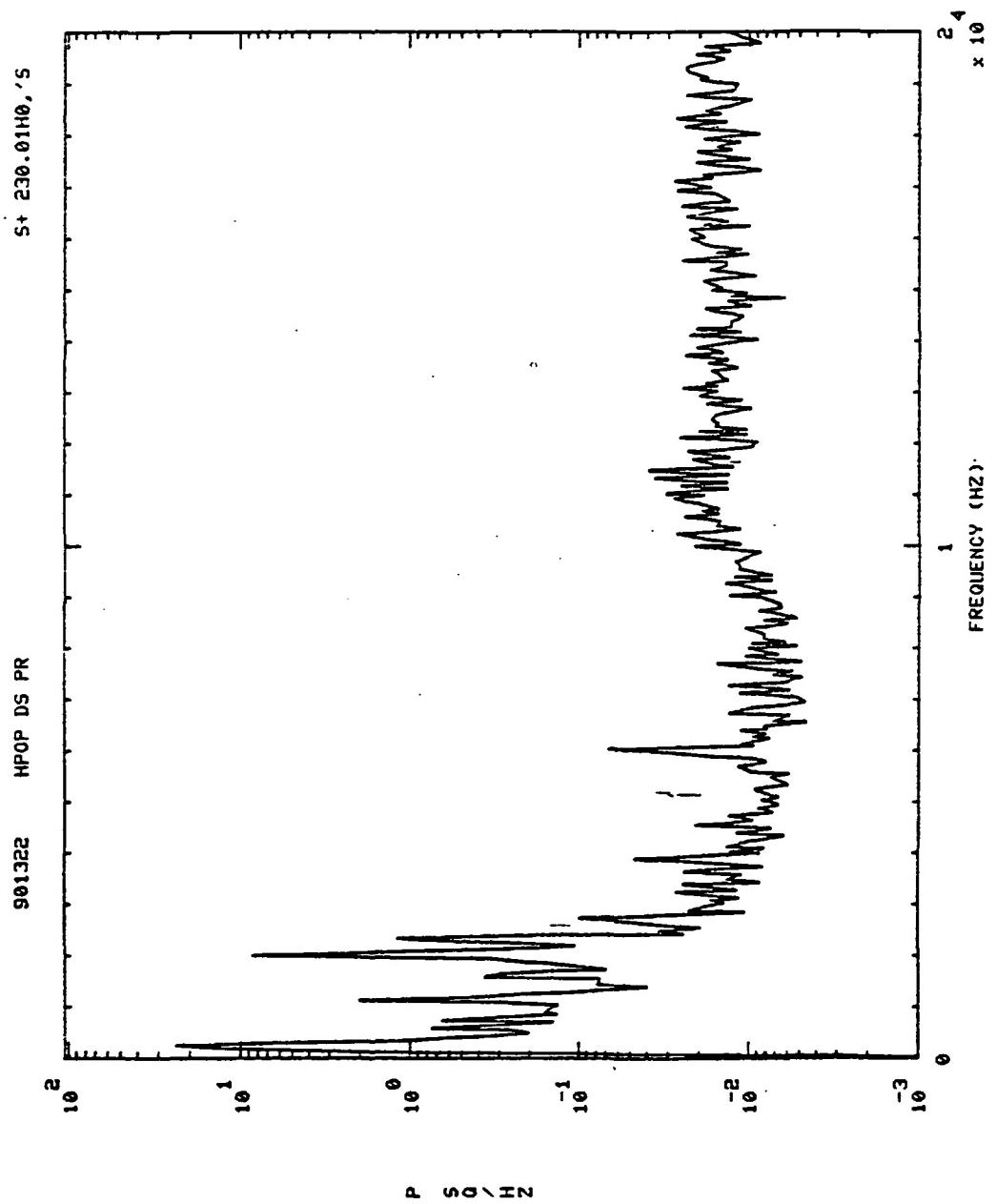


S+ 210.01H0, '6

HPOP DS PR

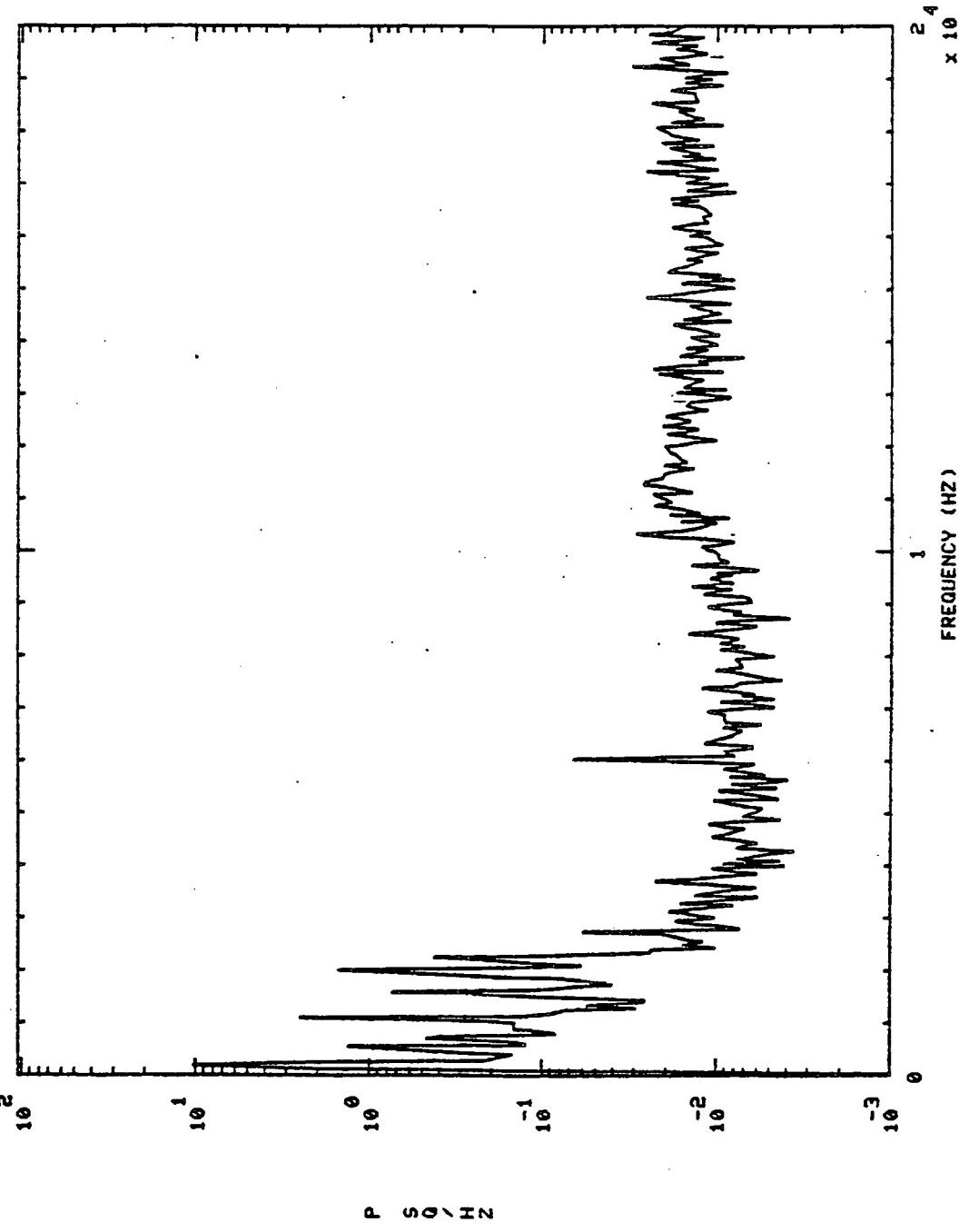
961322

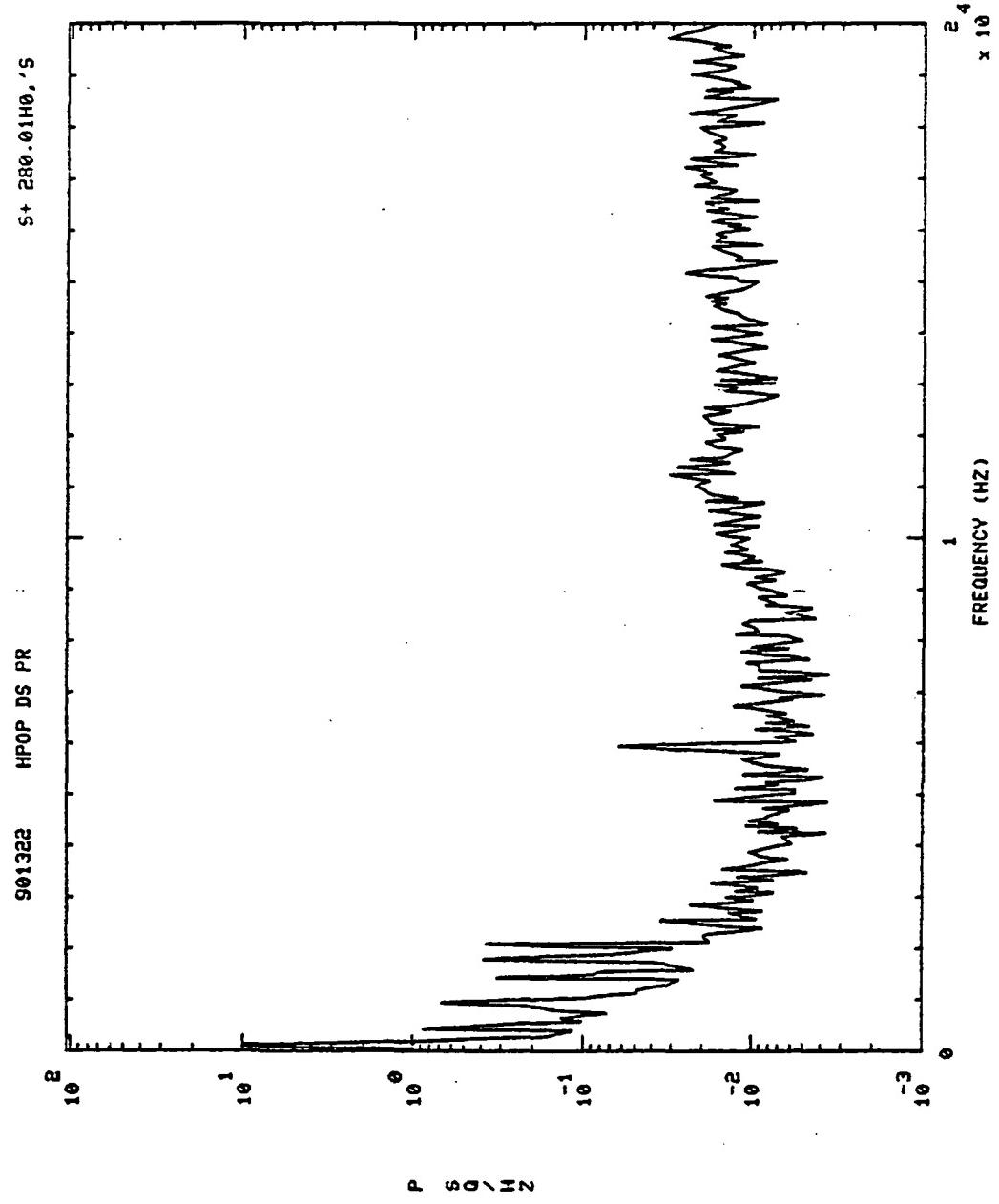


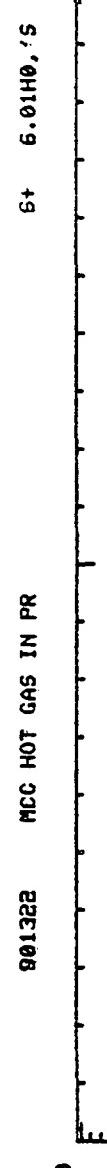


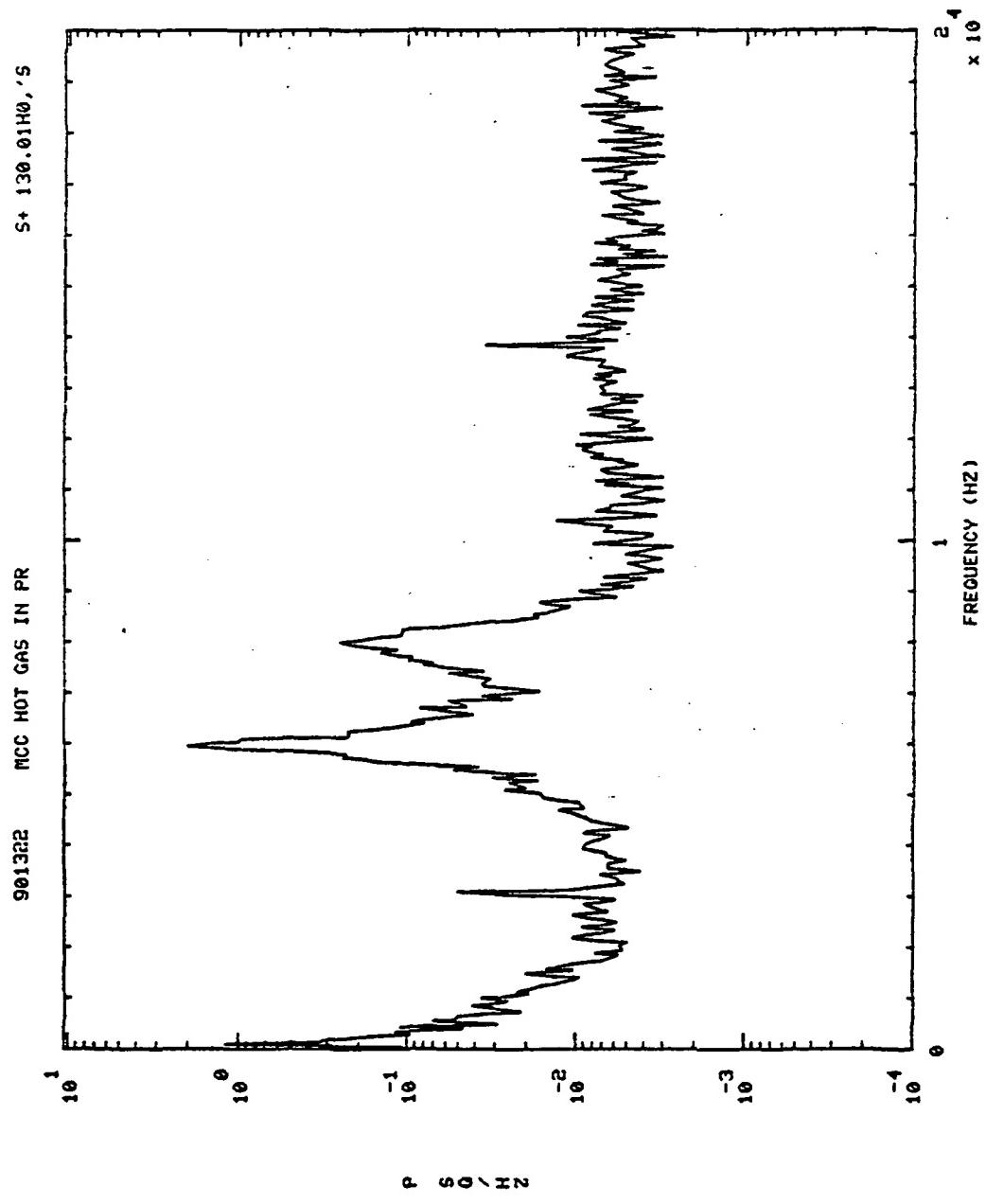
$\zeta + 260.01H_0$, s

901322 HPOP DS PR

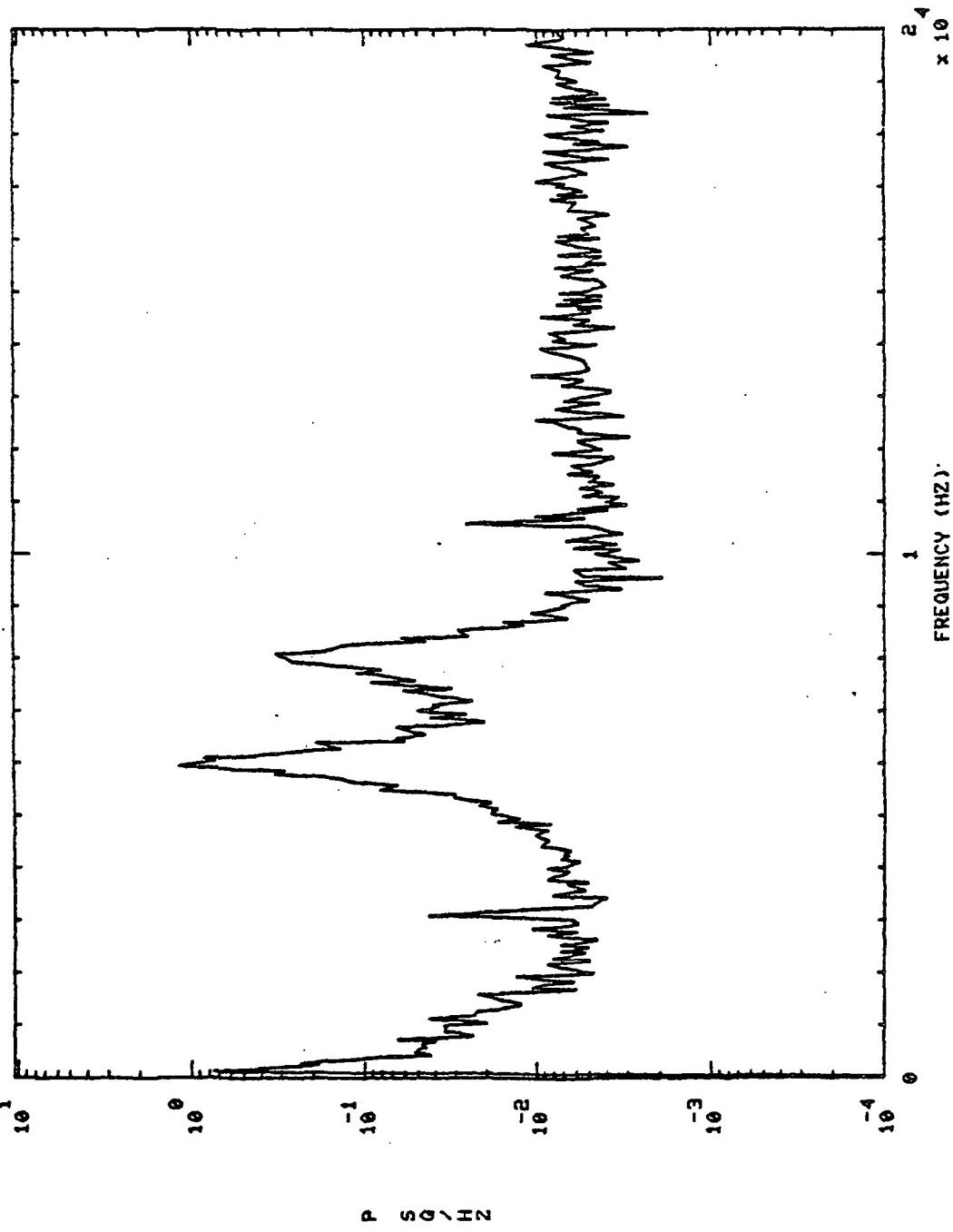


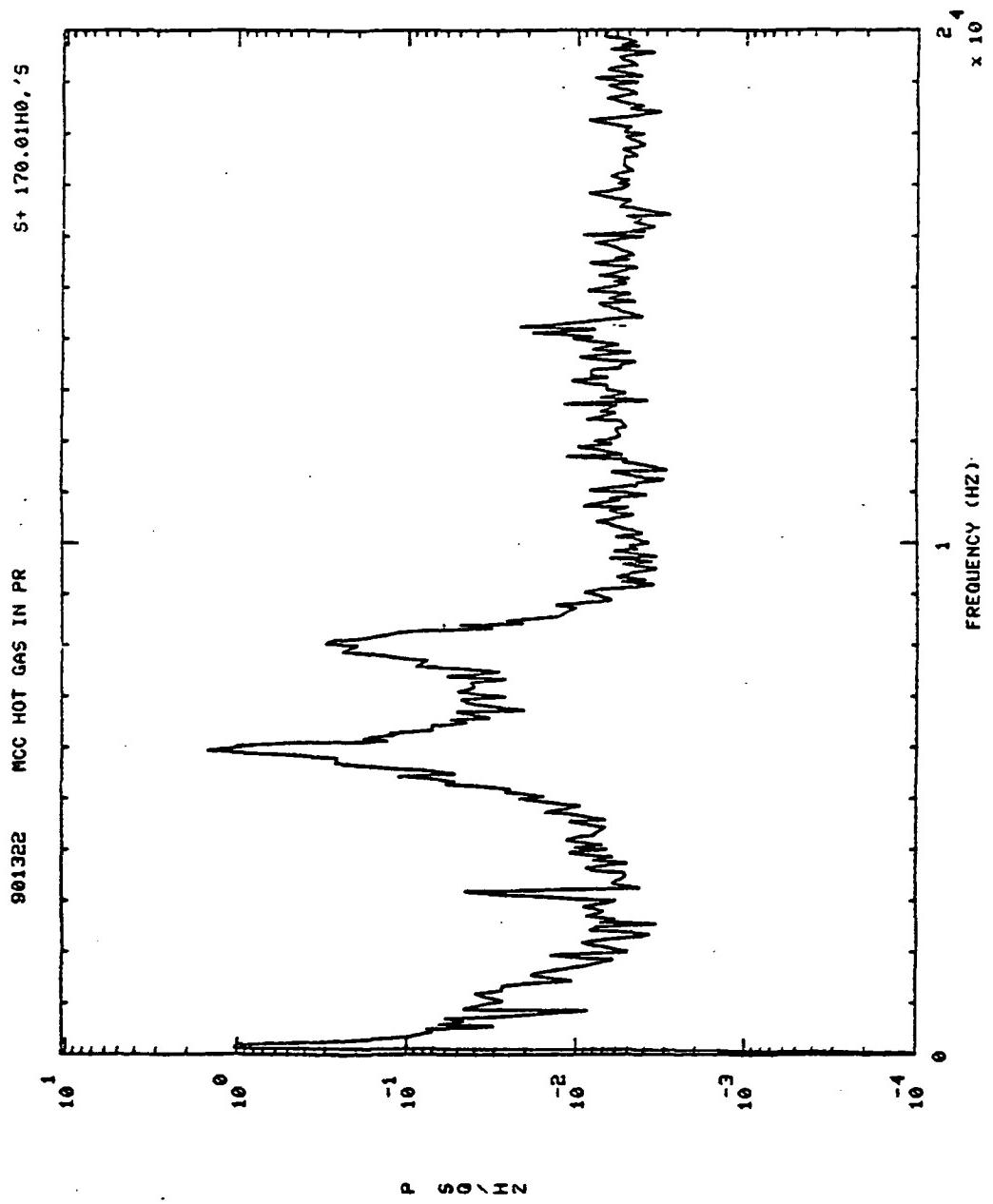






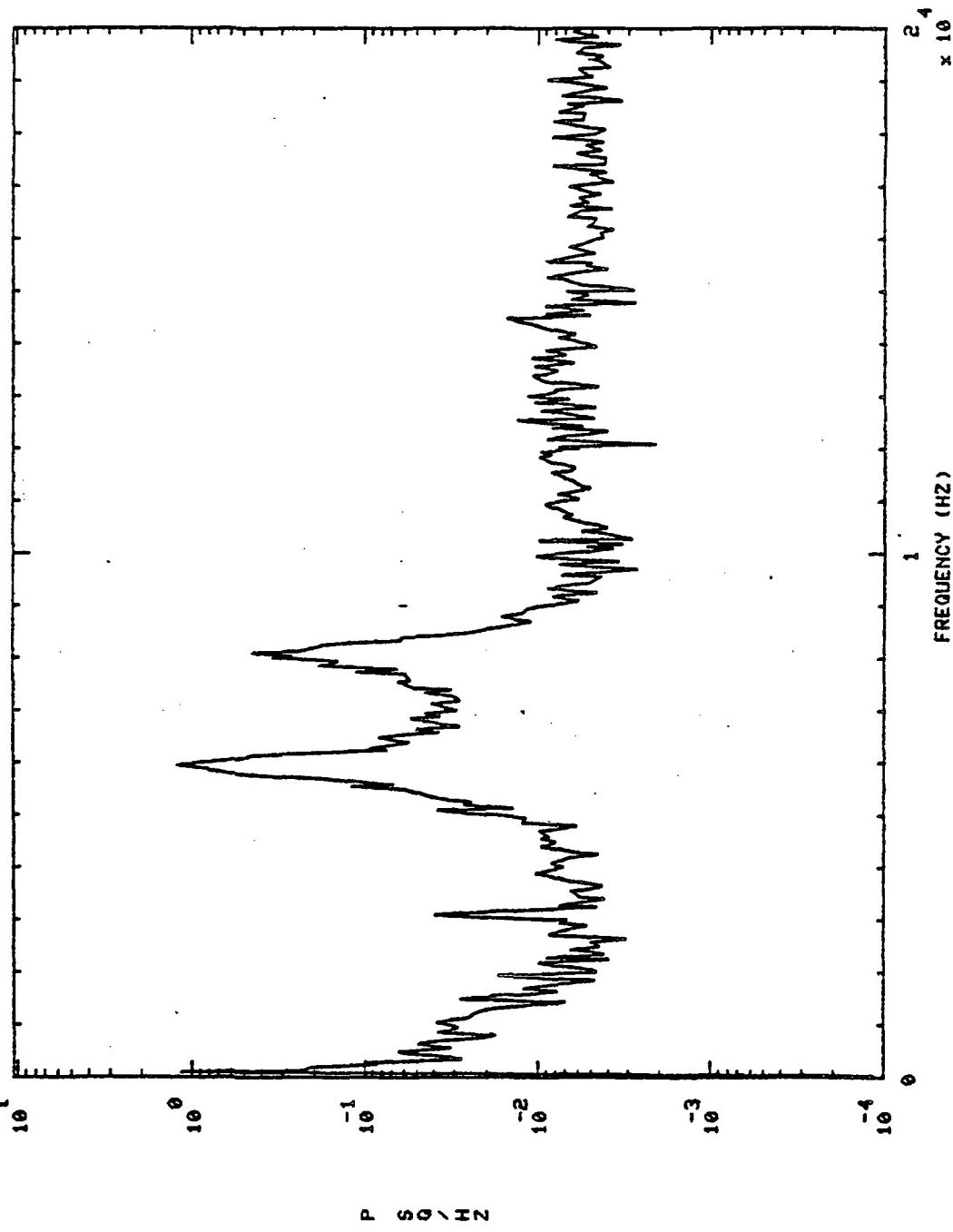
901322 PICC HOT GAS IN PR
5+ 150.01H0, 'S

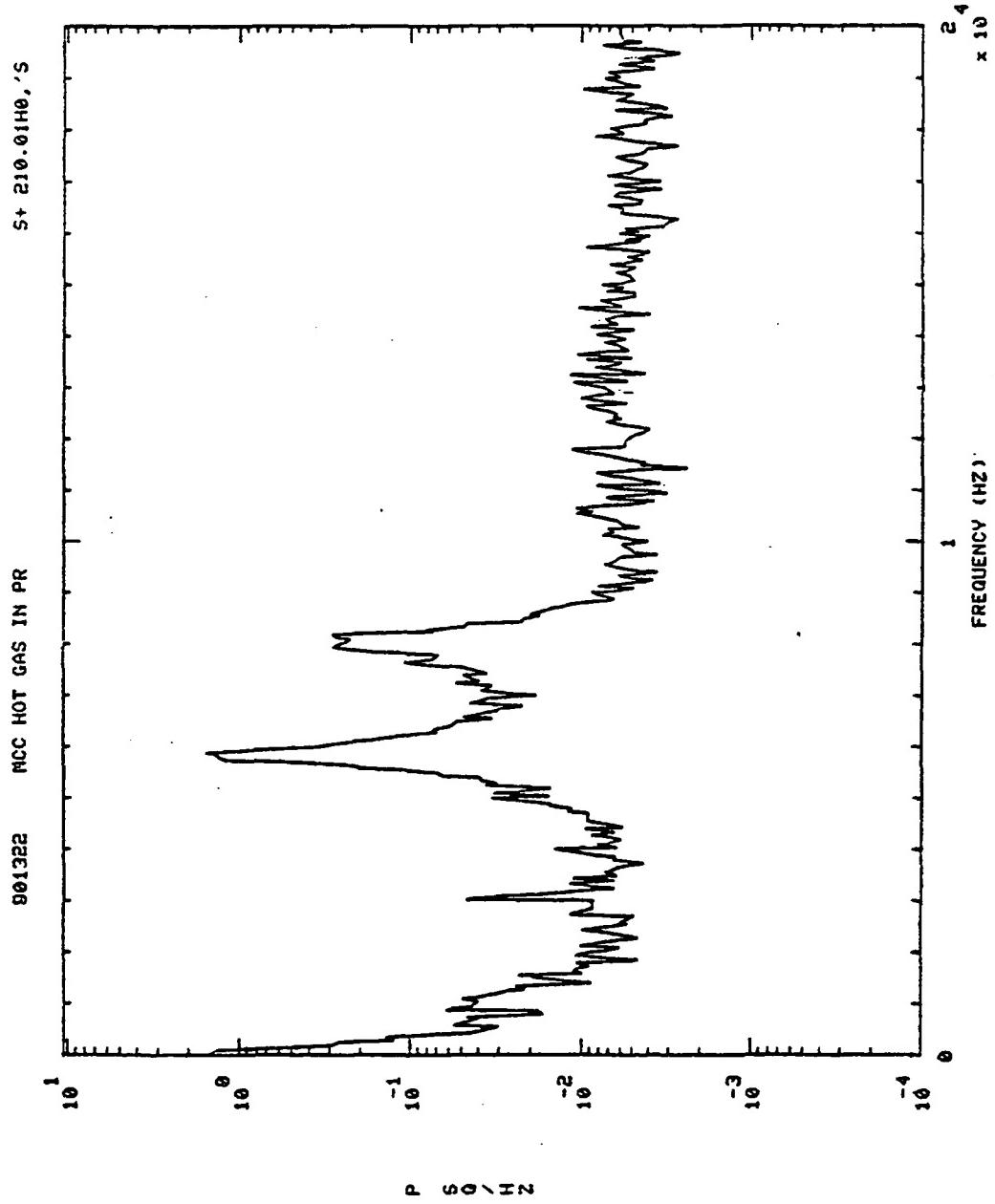




S+ 190.01H0.'S

901322 MCC HOT GAS IN PR

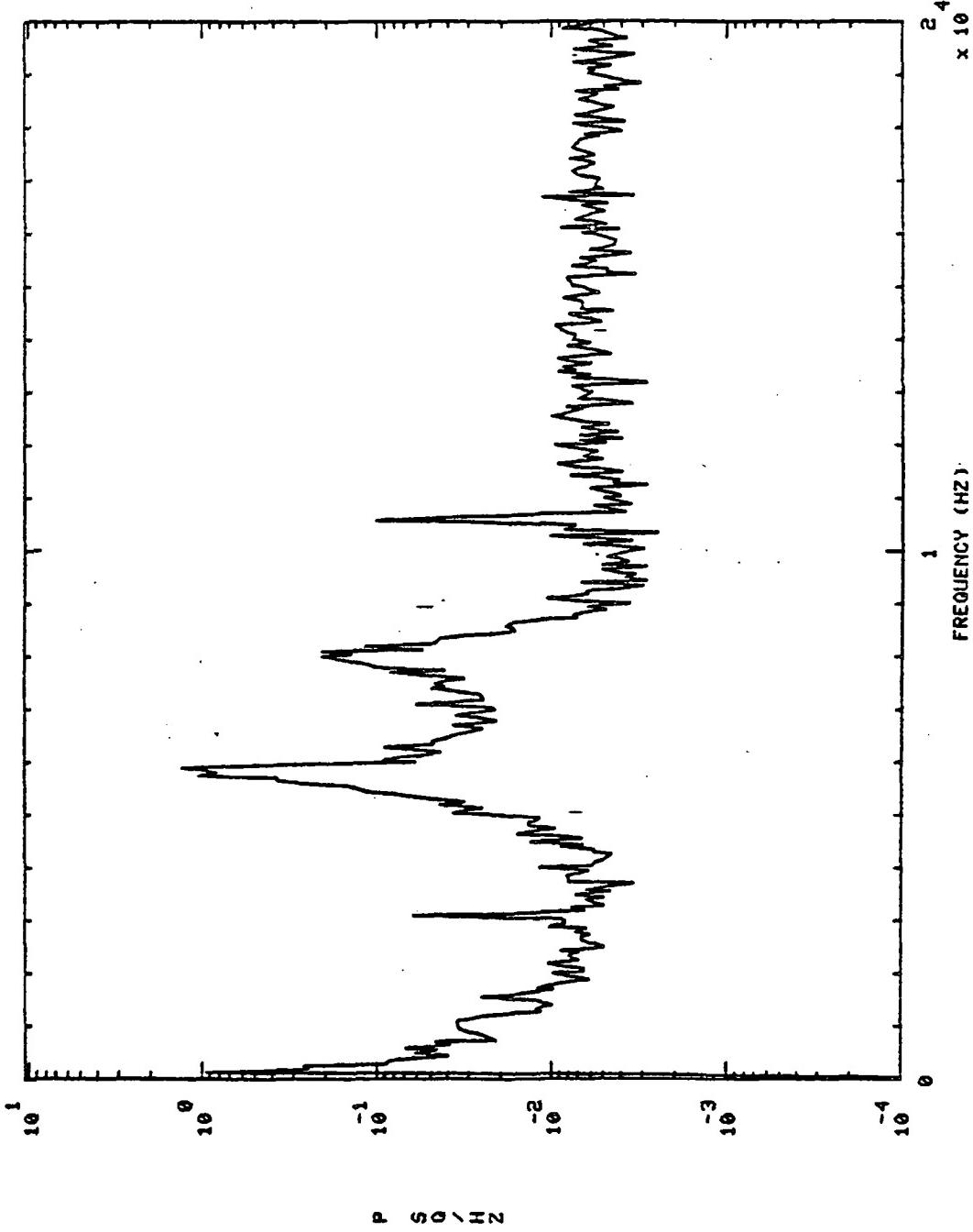




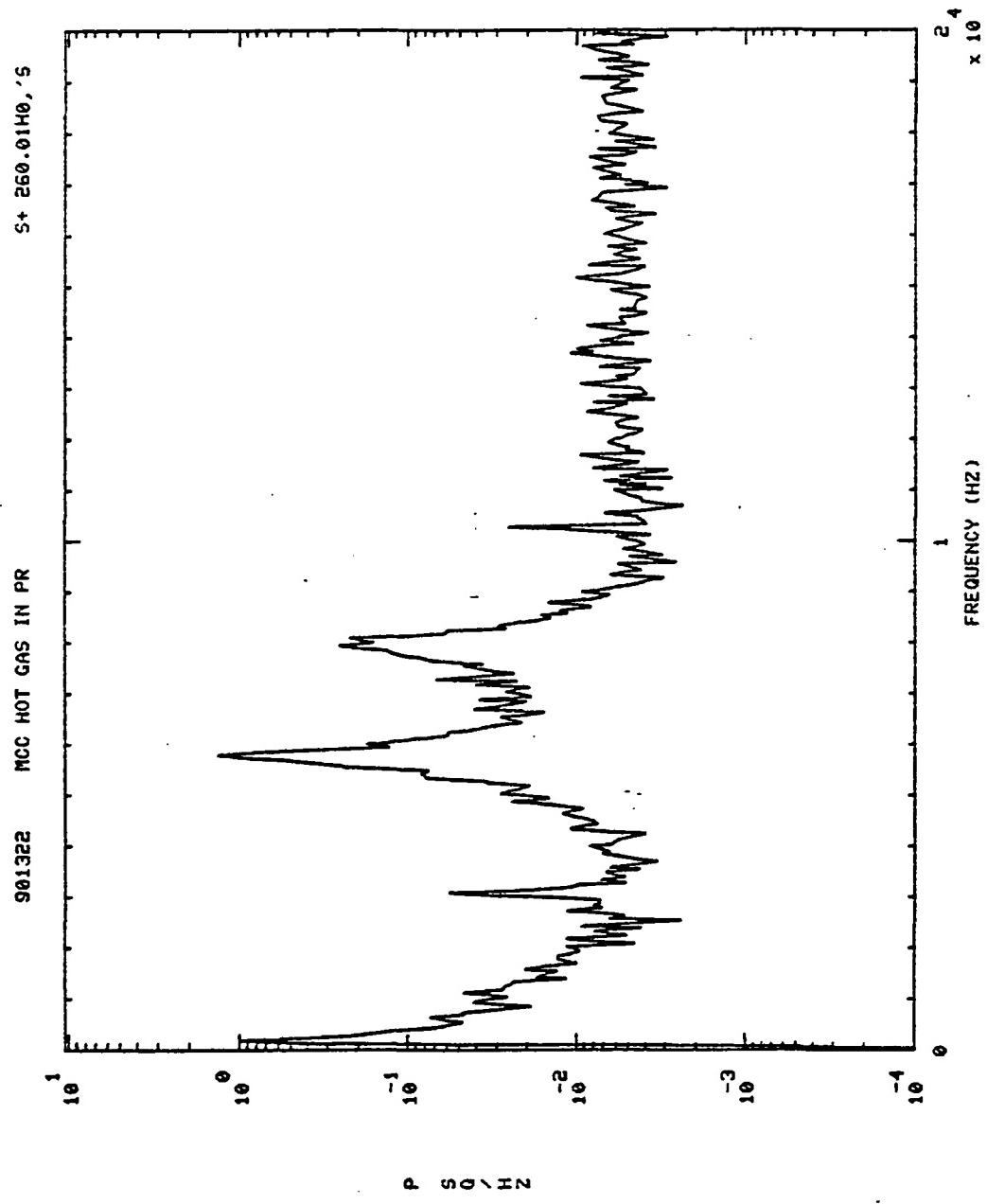
S+ 230.61Hz, 'S

MCC HOT GAS IN PR

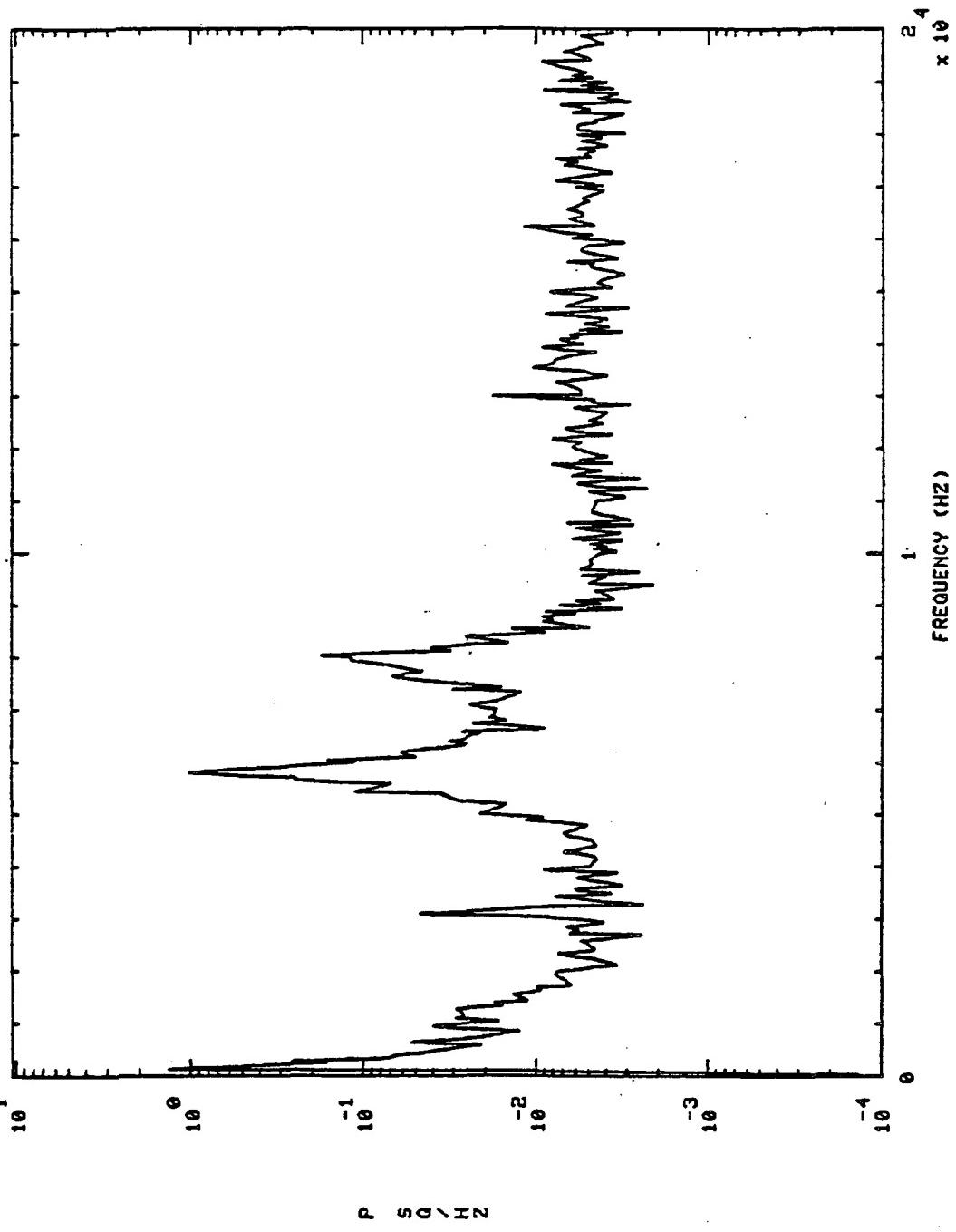
901322

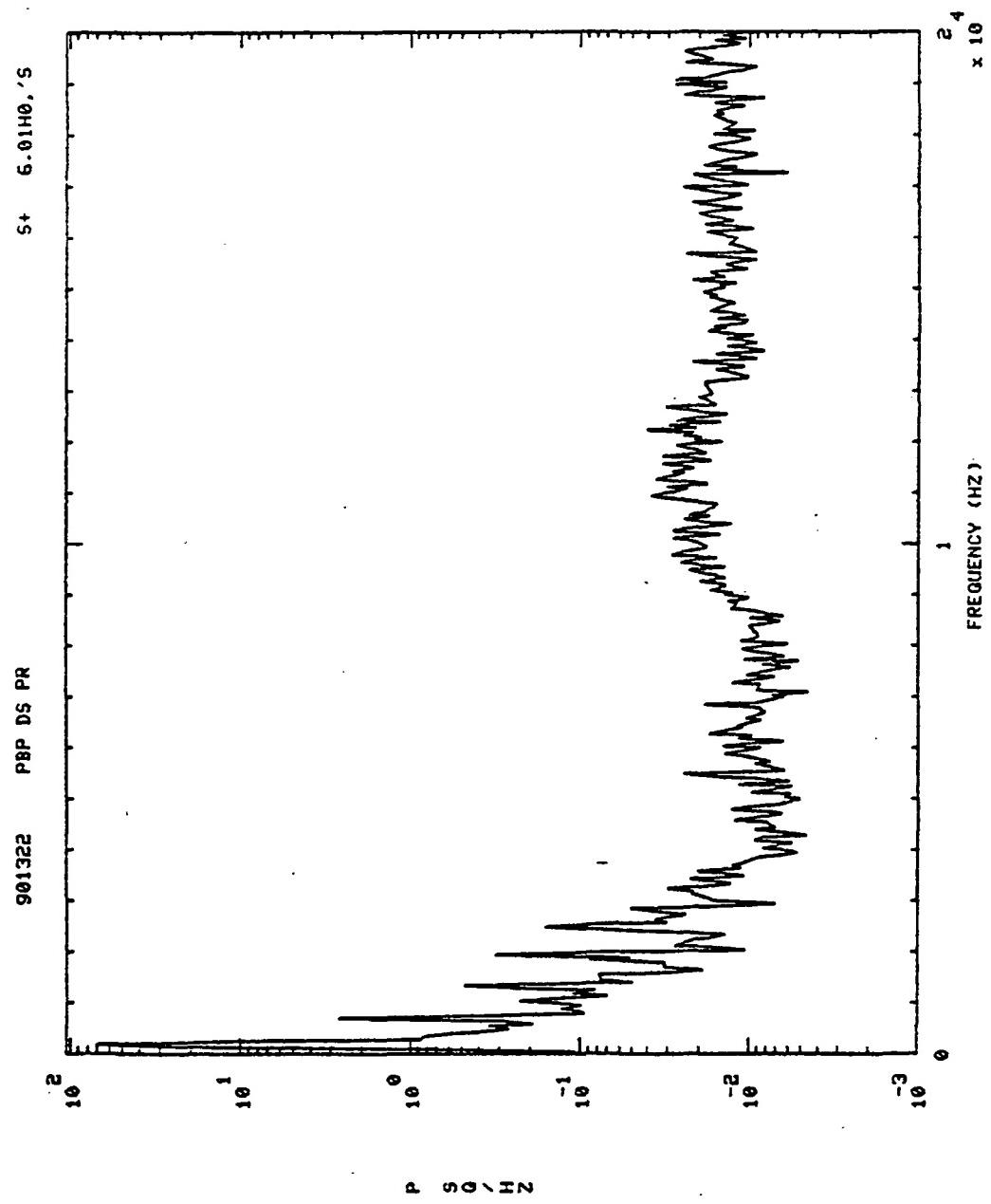


P S D / H Z

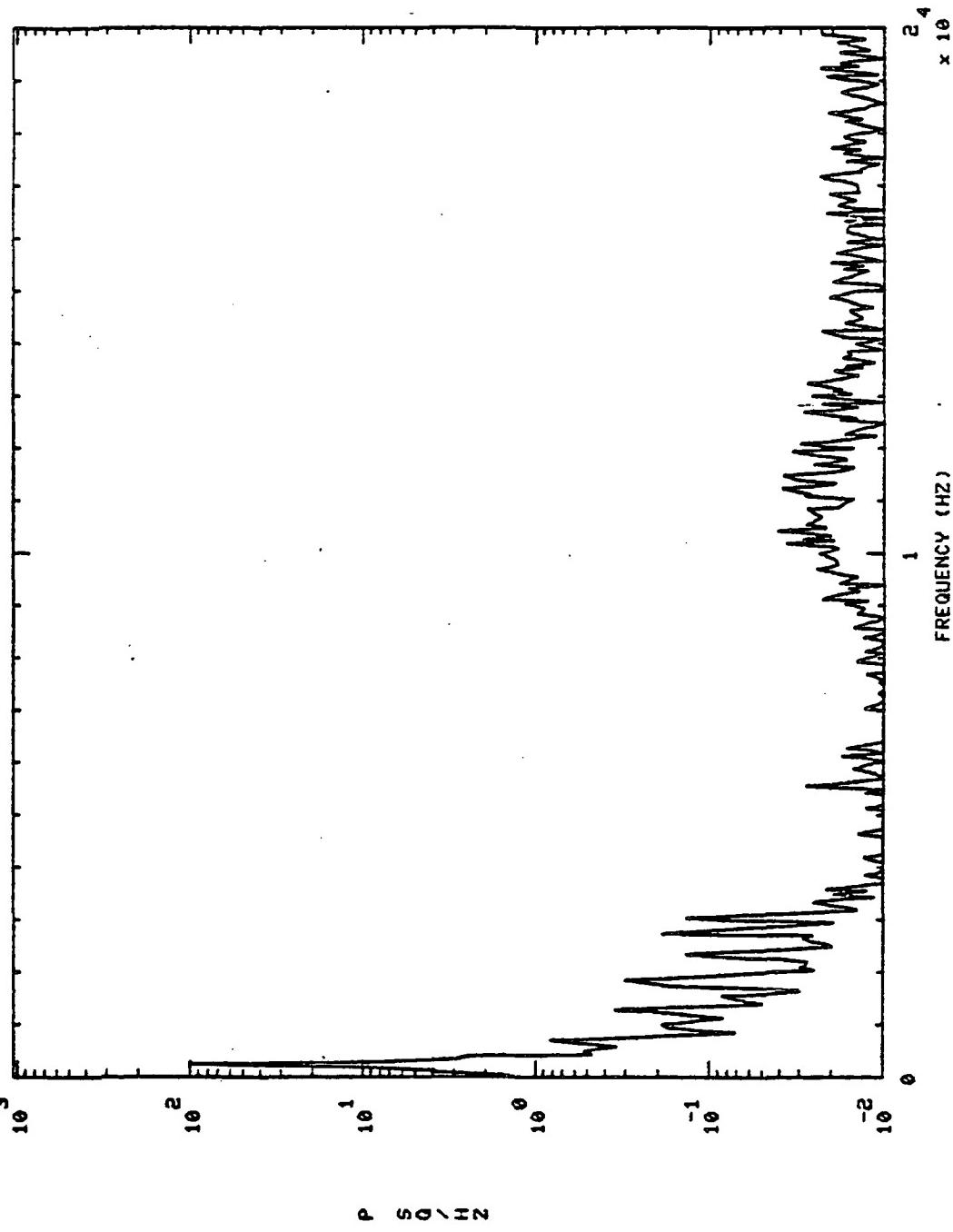


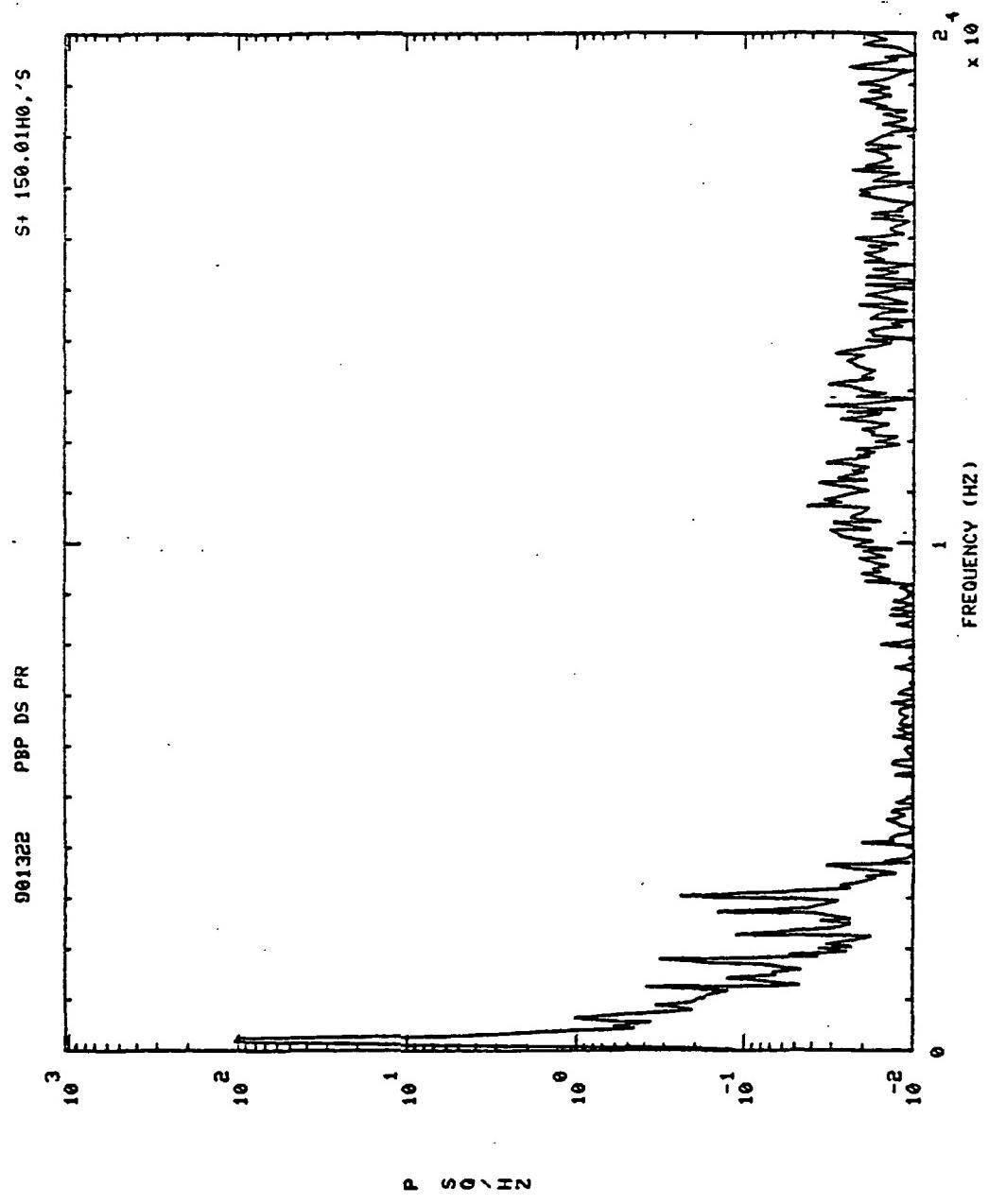
S+ 230.01 H0. '6
MCC HOT GAS IN PR
901322





901322 PBP DS PR S+ 130.01Hz, 5

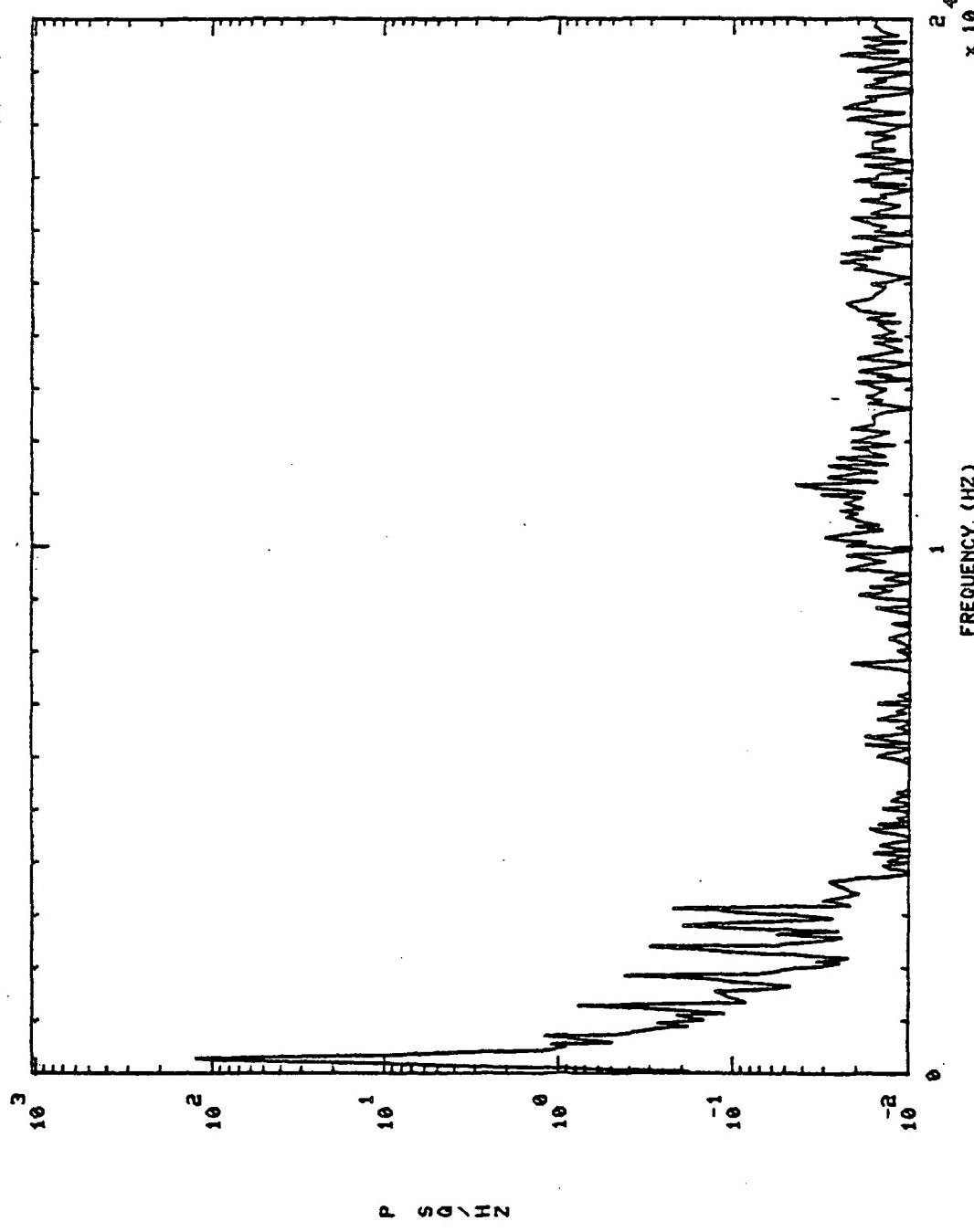


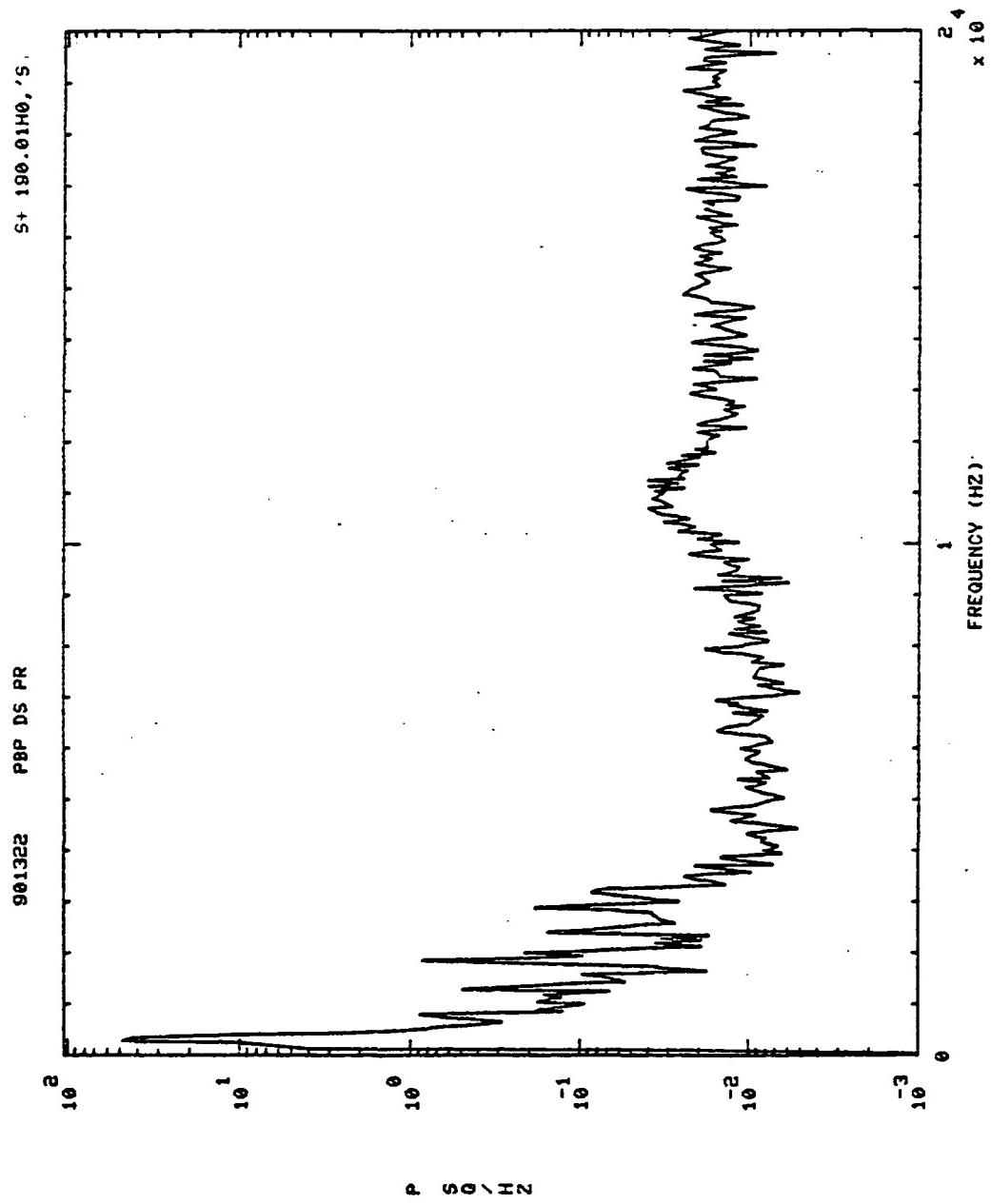


S+ 170.01H0.'S

PBP PS PR

901322

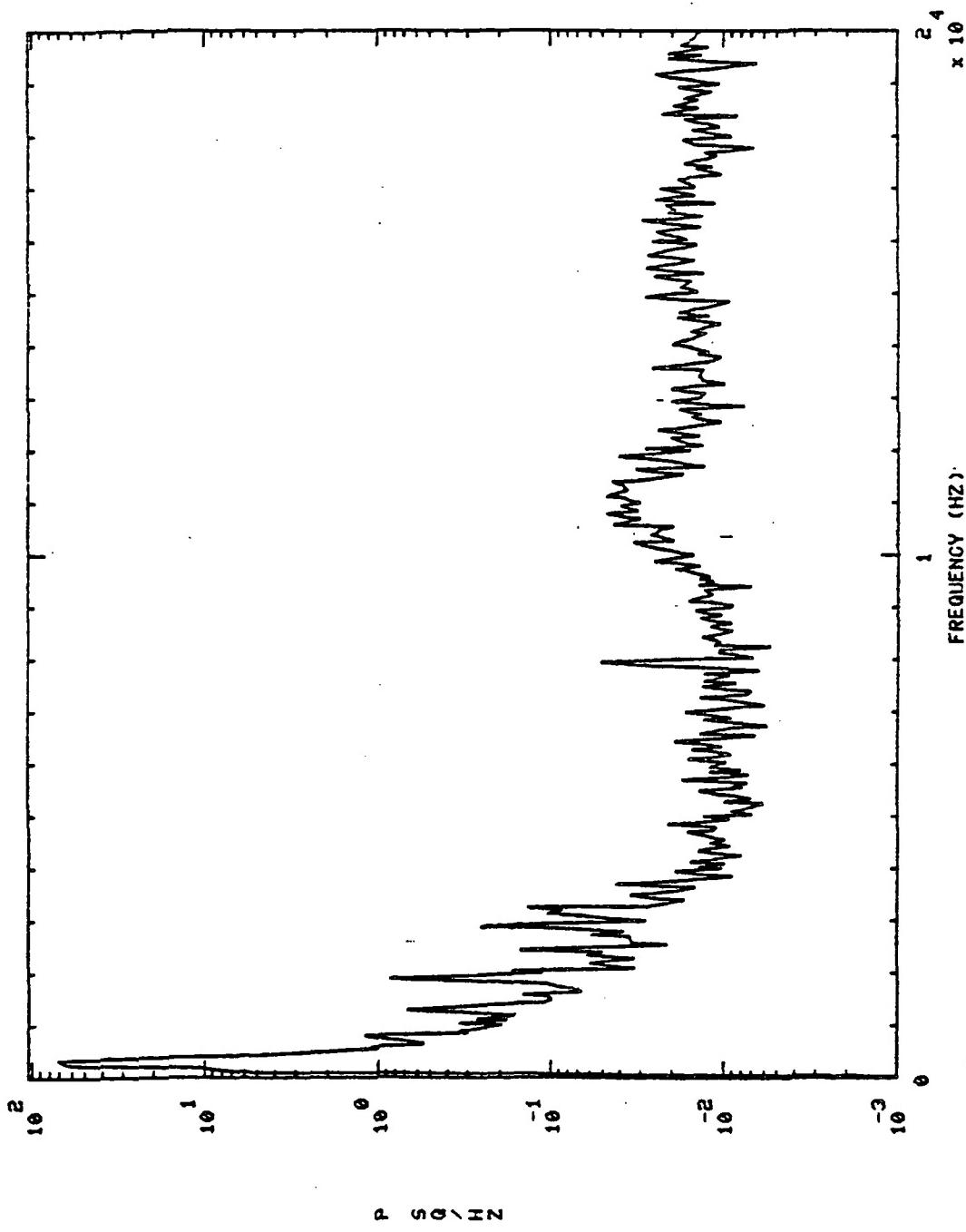


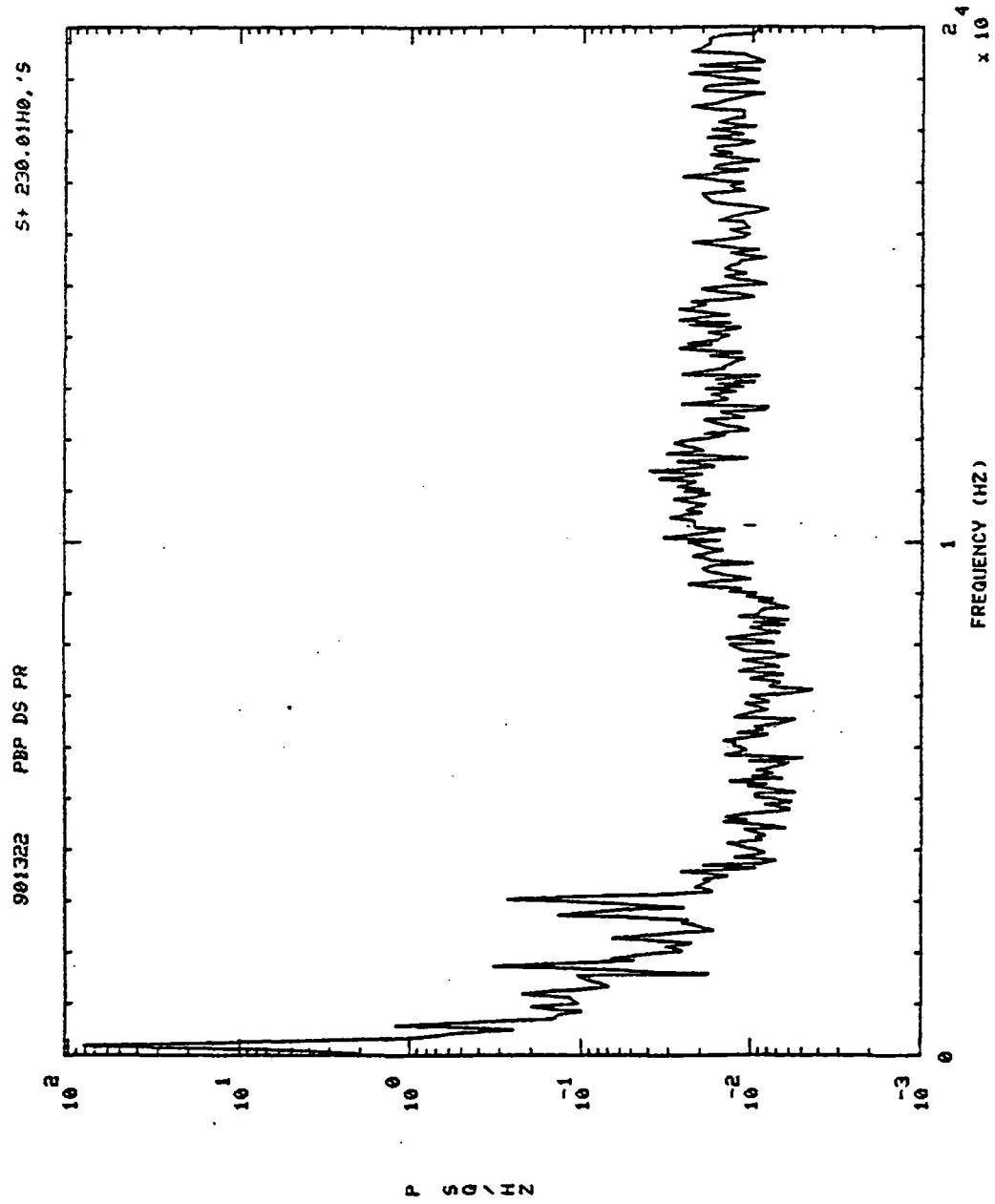


S+ 210.01H0.'S

PBP DS PR

901322

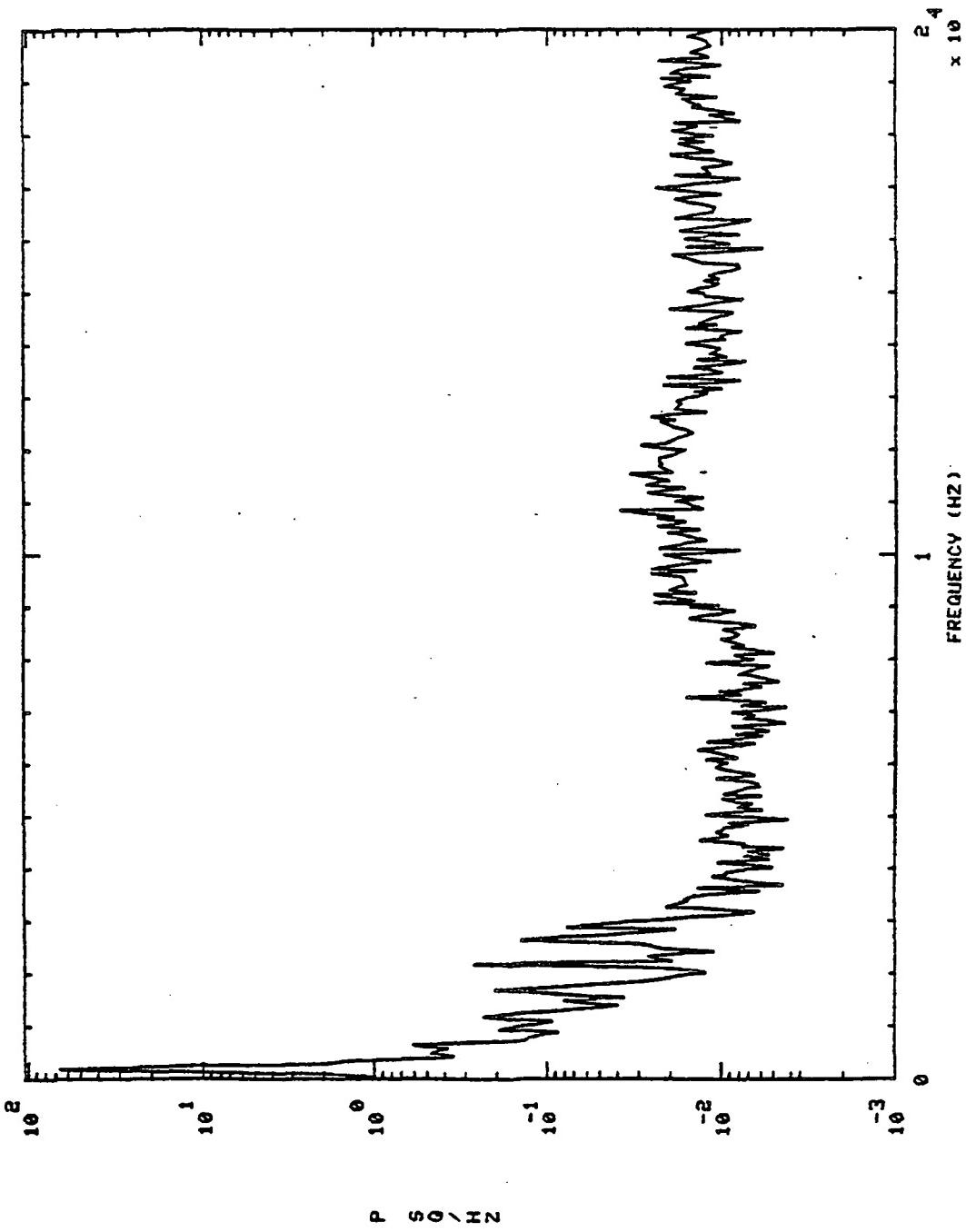




S+ 264.01H0, 'S

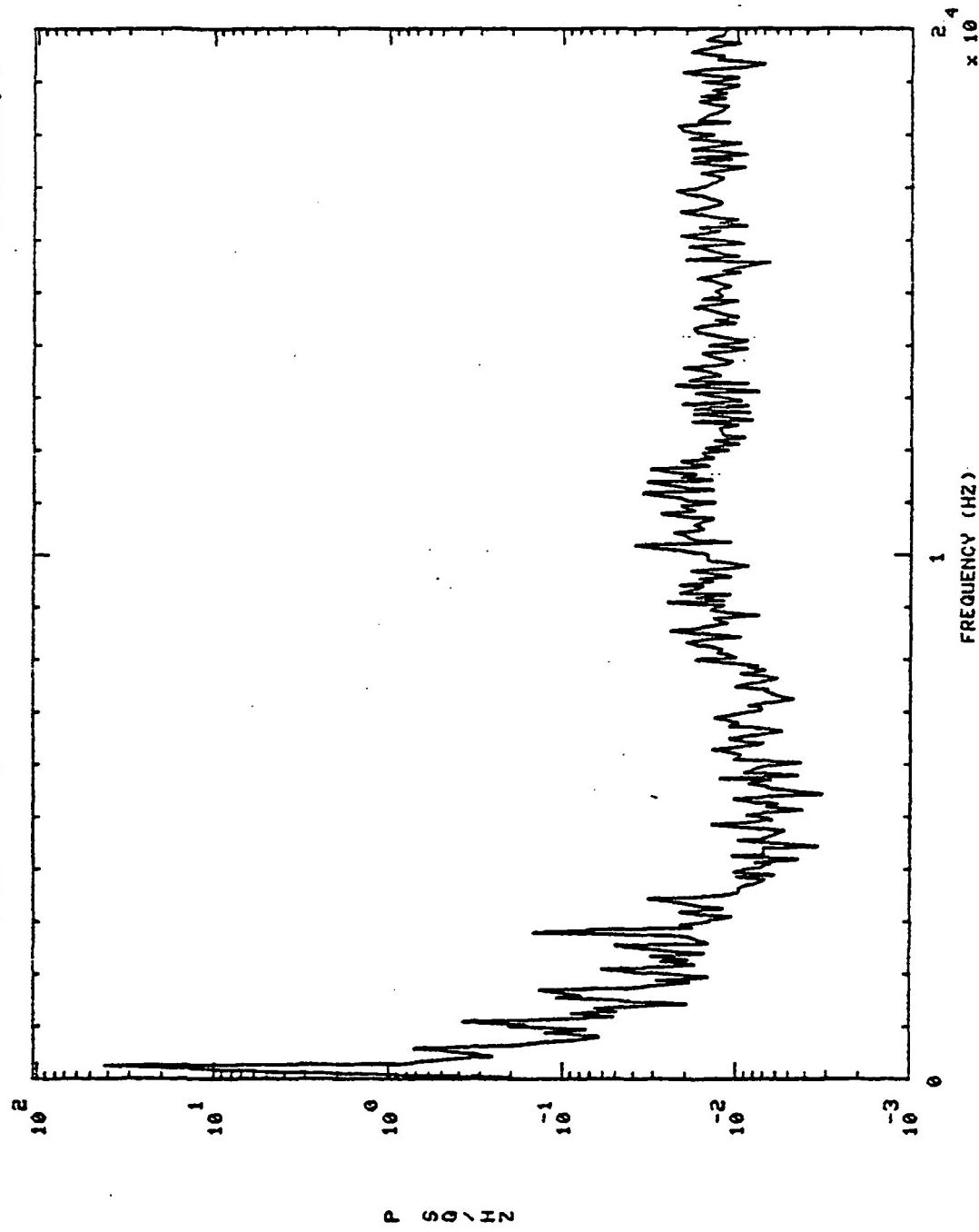
PBP DS PR

S01322



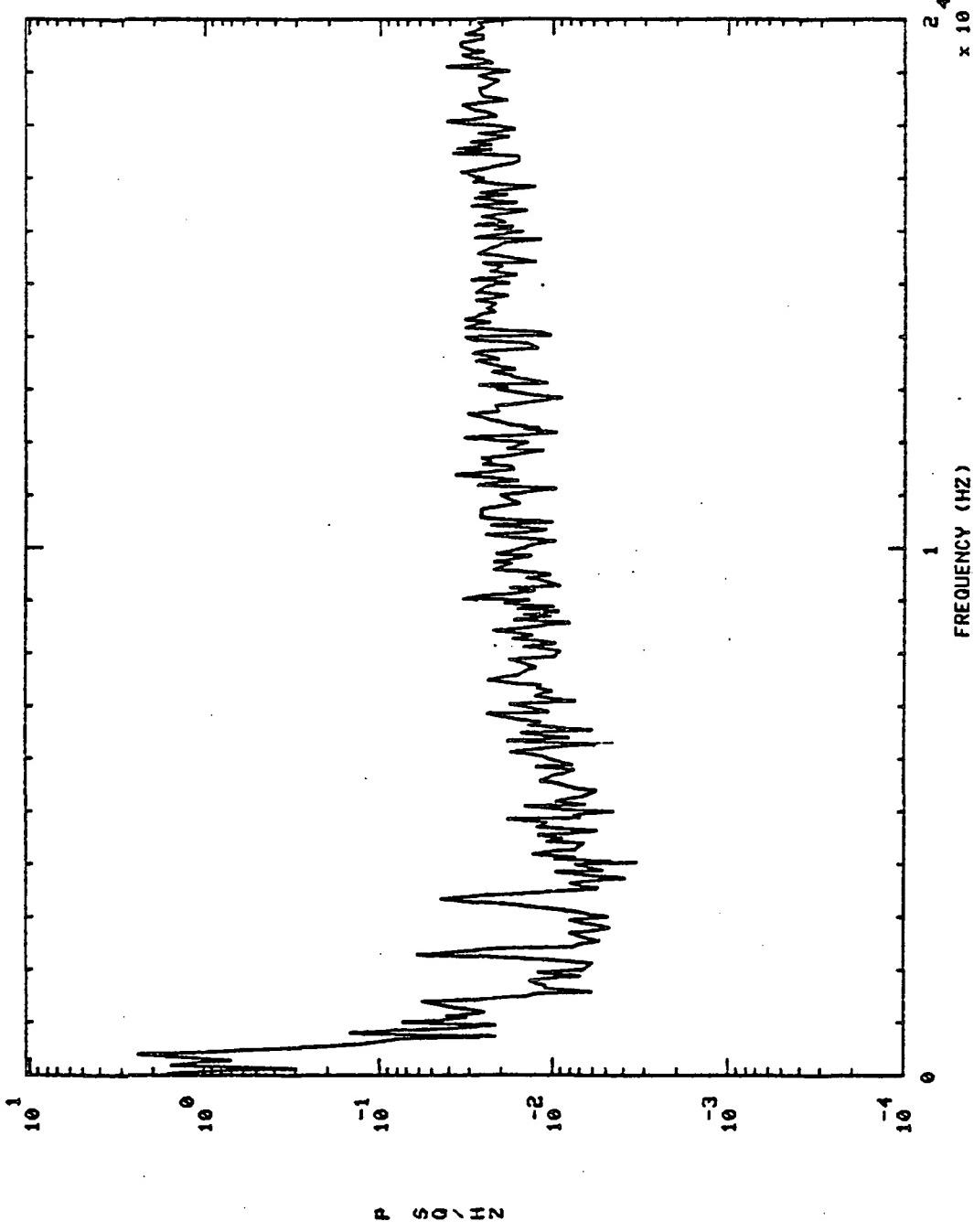
901322 PBP DS PR

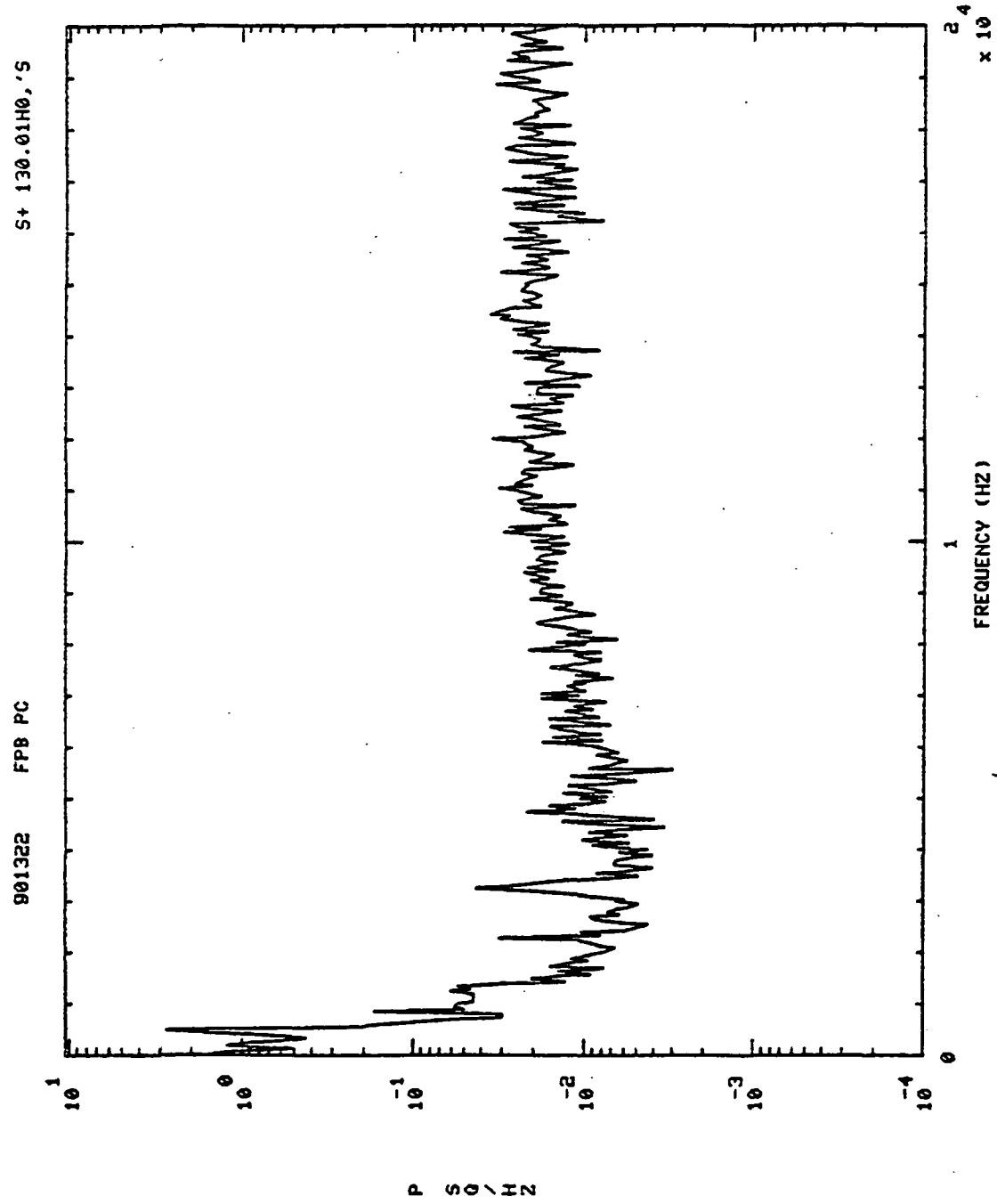
S+ 284.01H0.'S



S+ 6.01H0.'S

901322 FPB PC

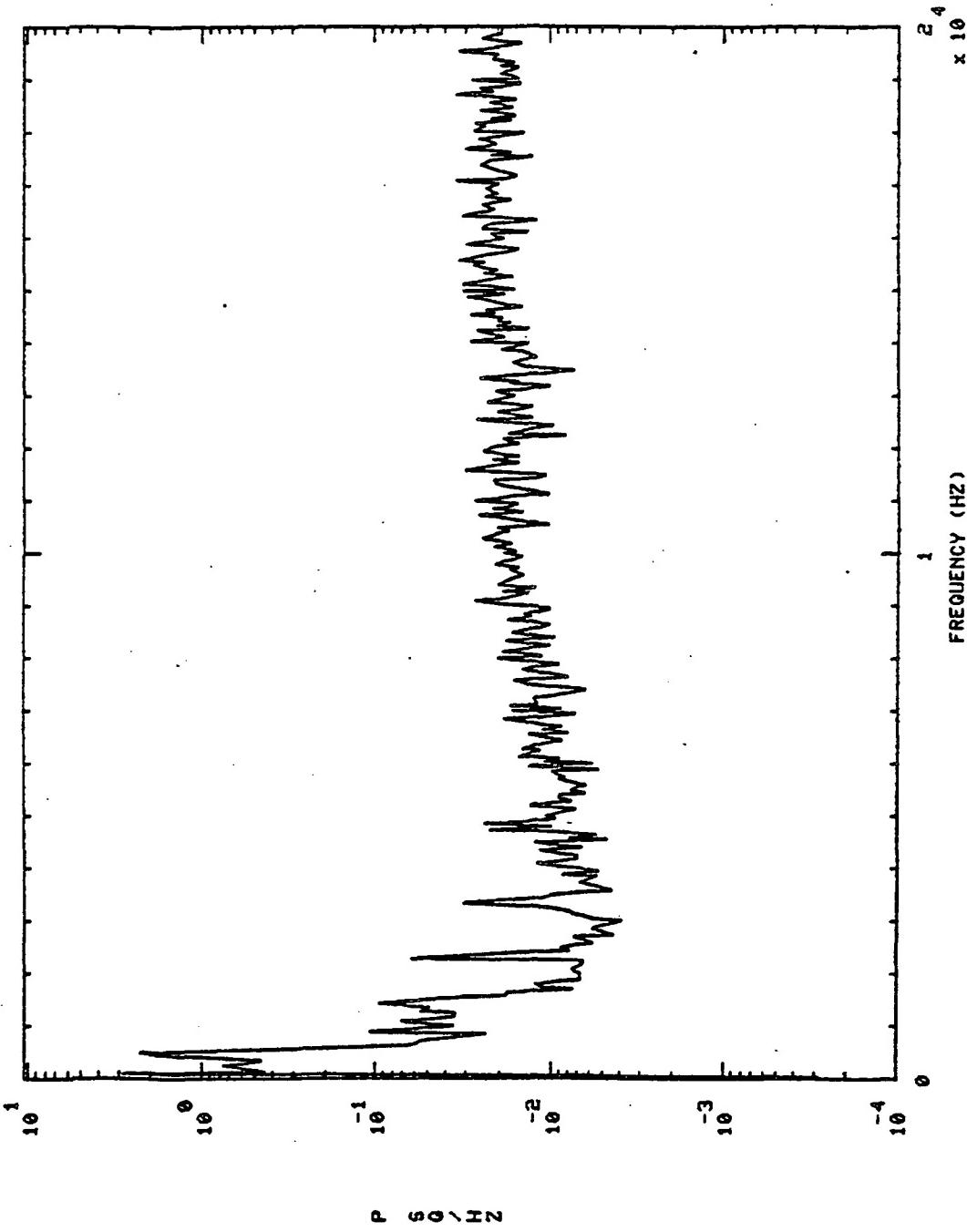




SI 150.01H0.5

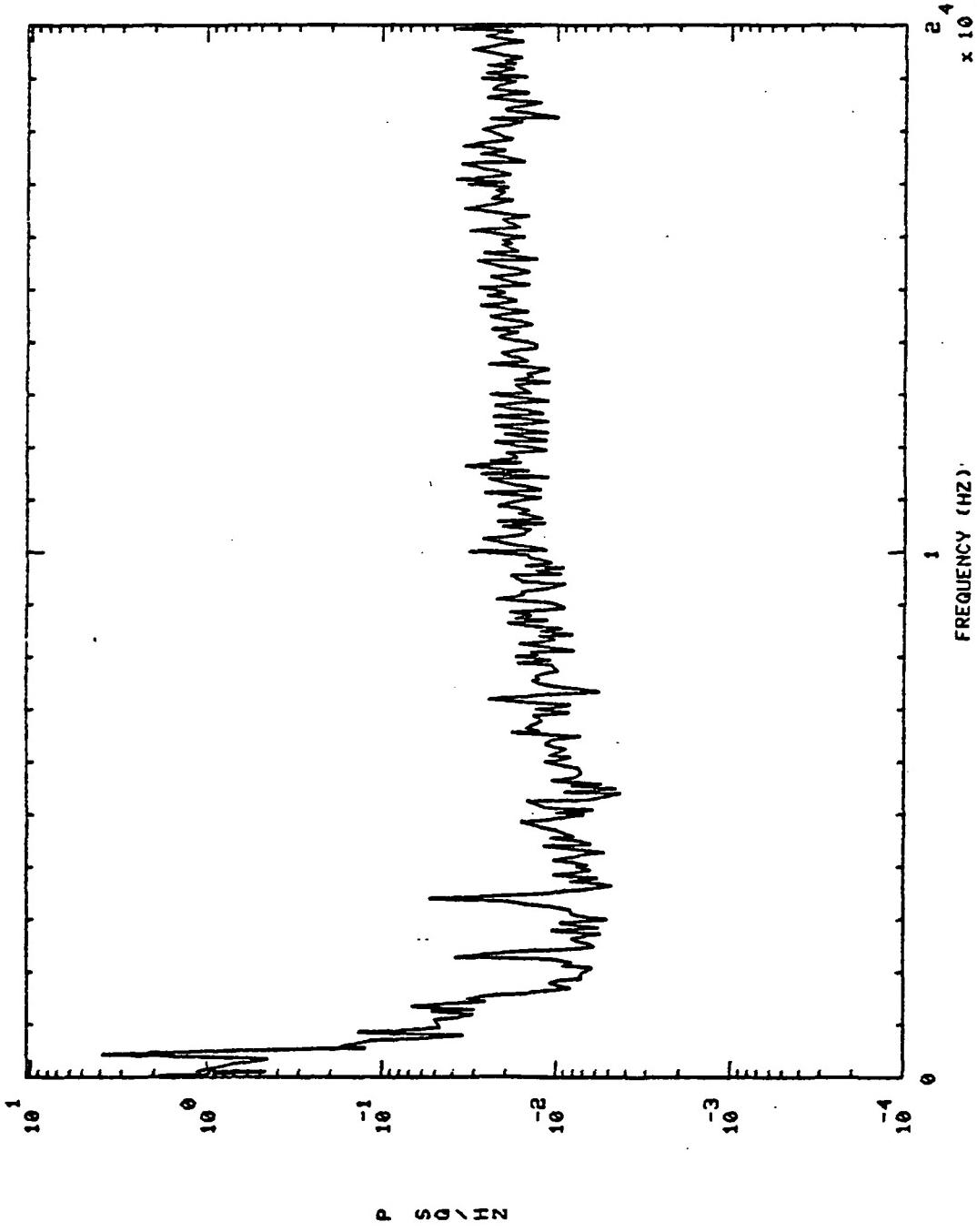
FPB PC

901322



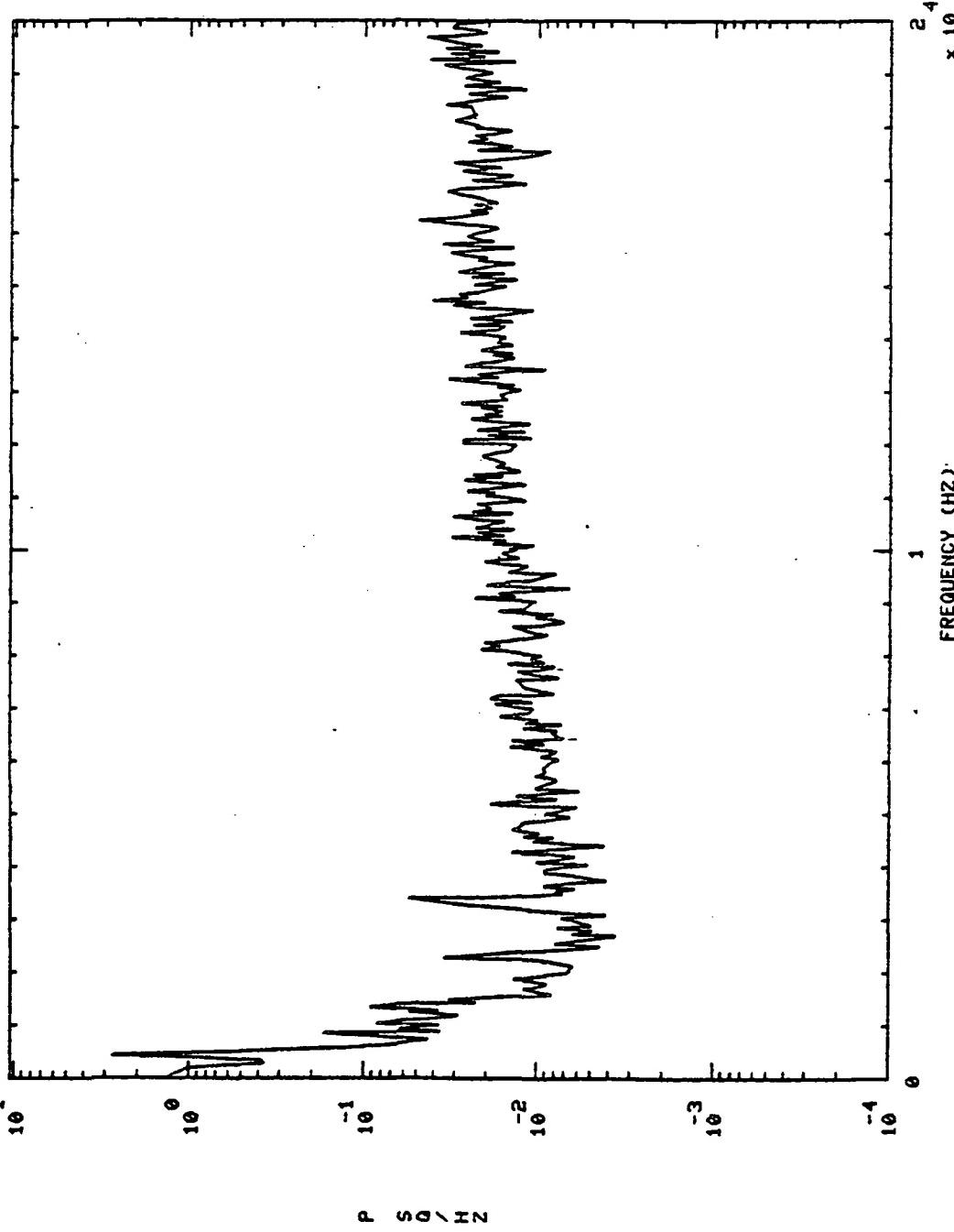
901322 FFB PC

S+ 170.01H0. S.



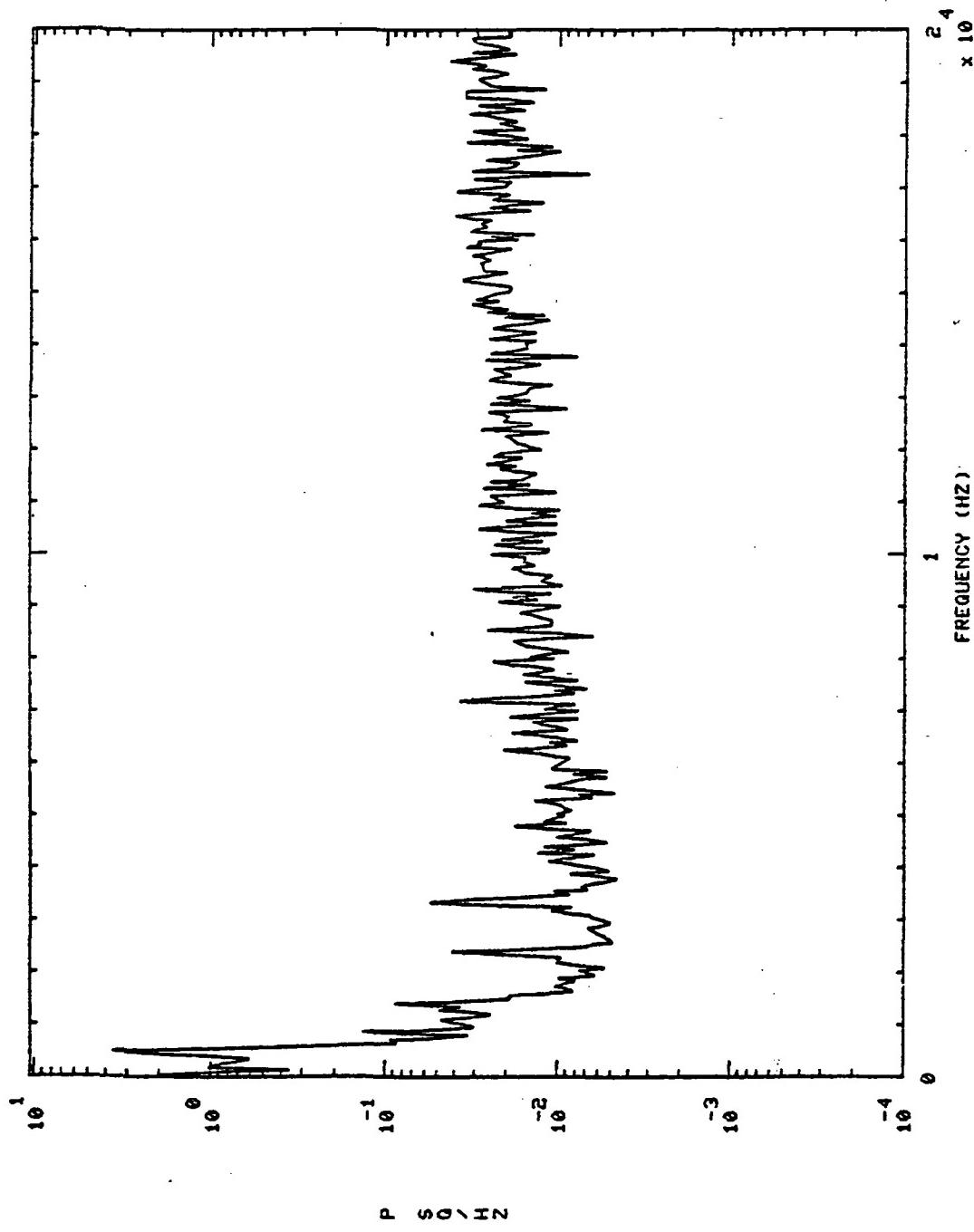
S+ 190.01H0, 'S

901322 FPB PC



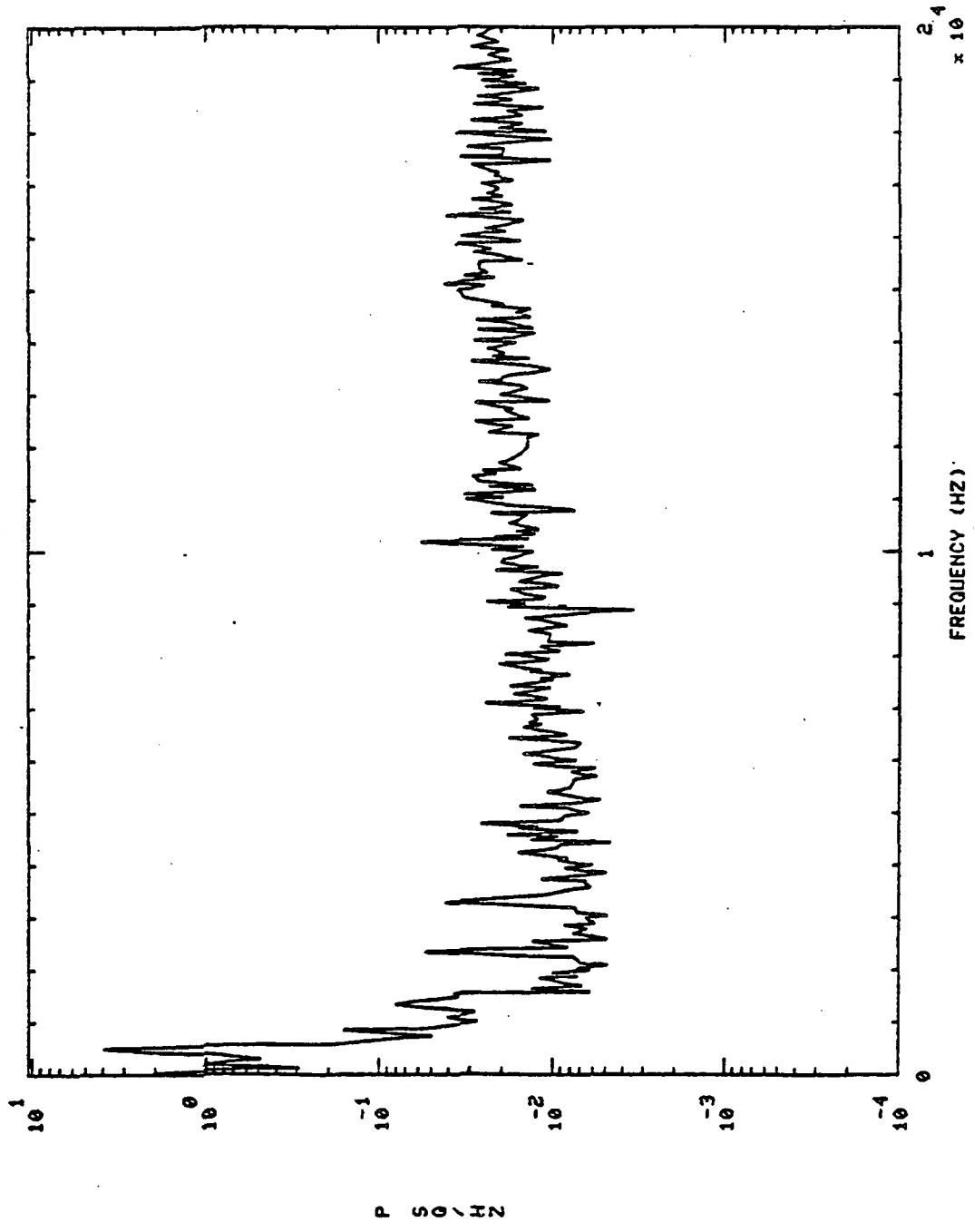
901322 FPB PC

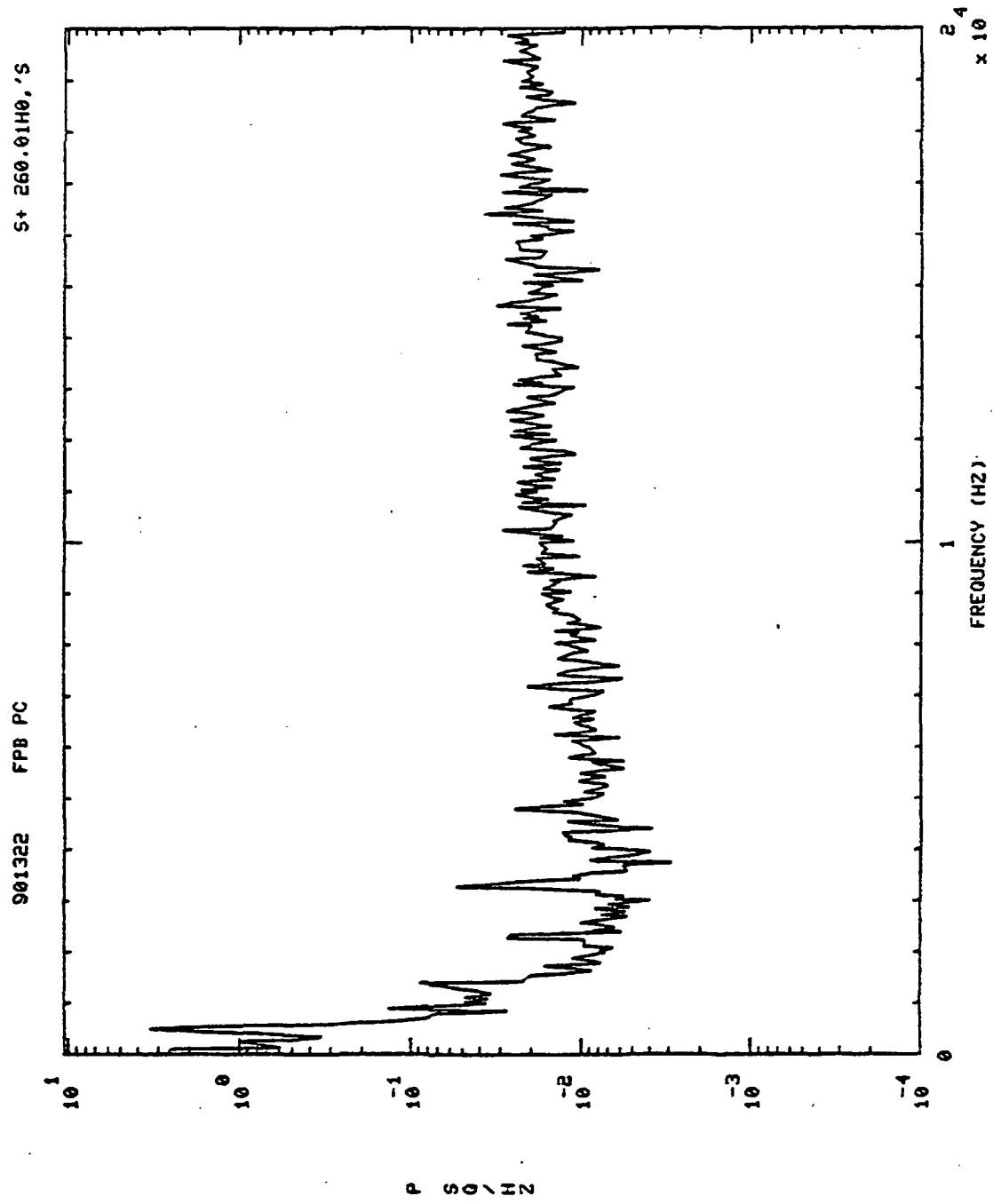
S+ 210.01H0, '5

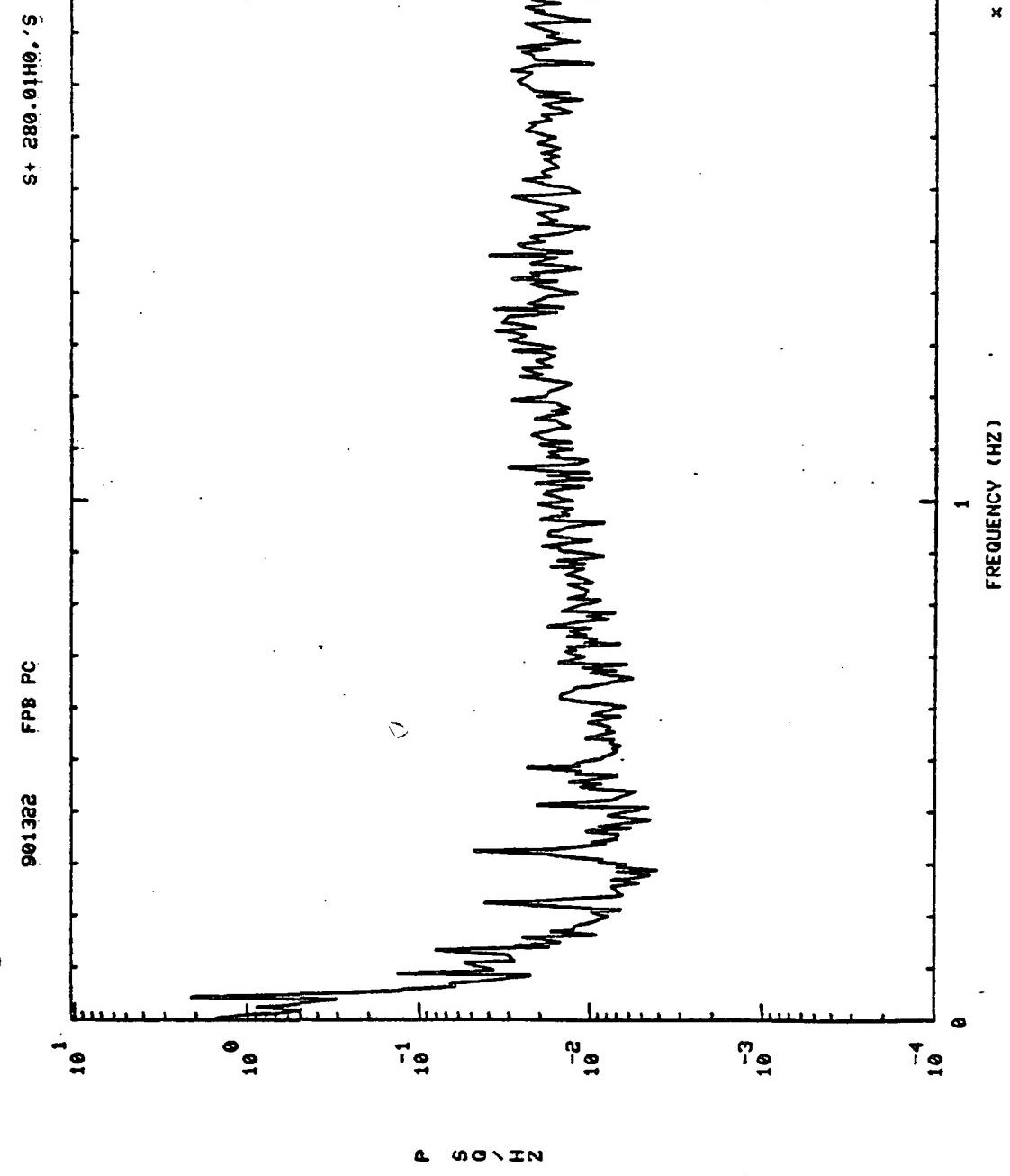


S+ E30.01H0.'S

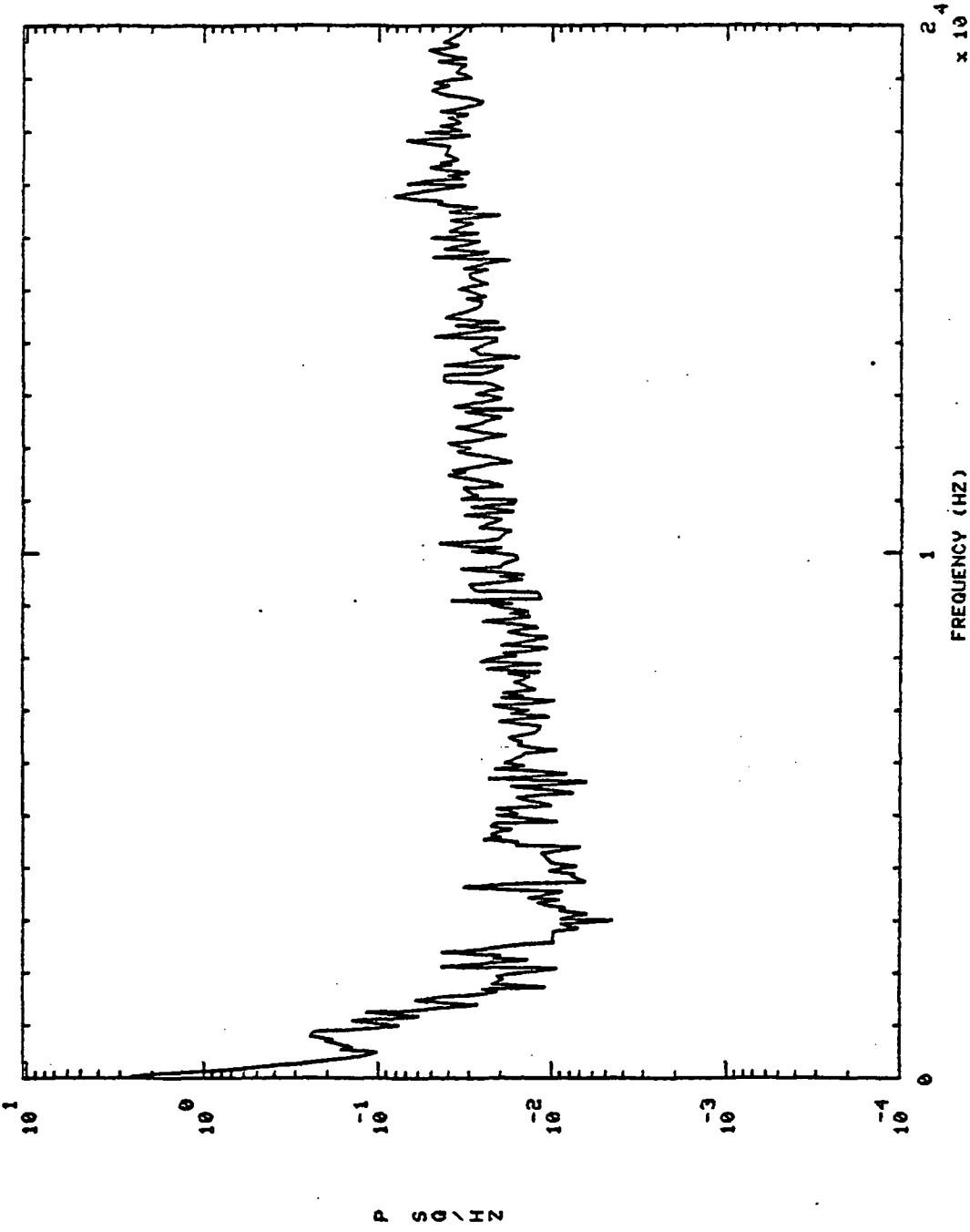
901322 FPB PC



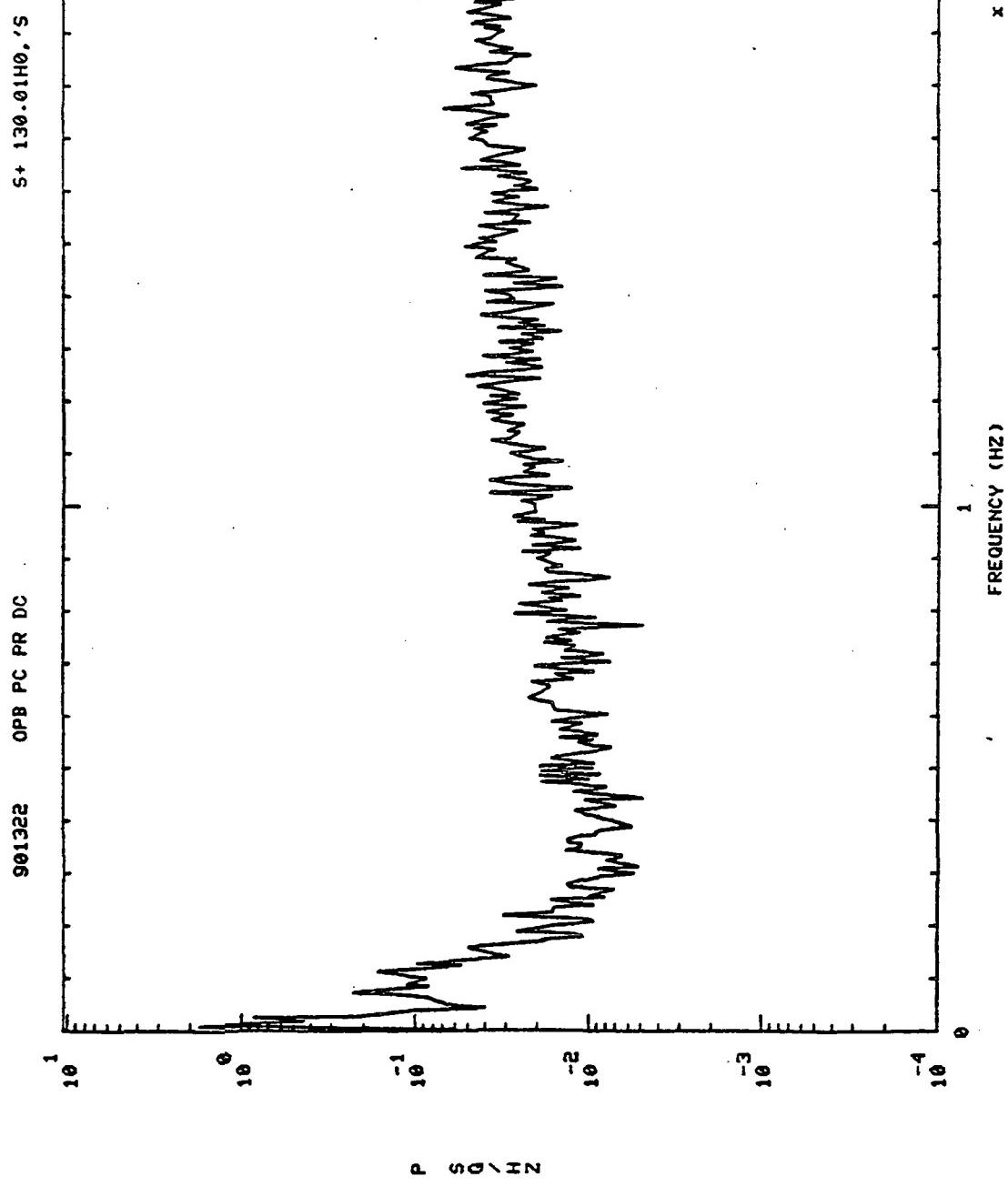


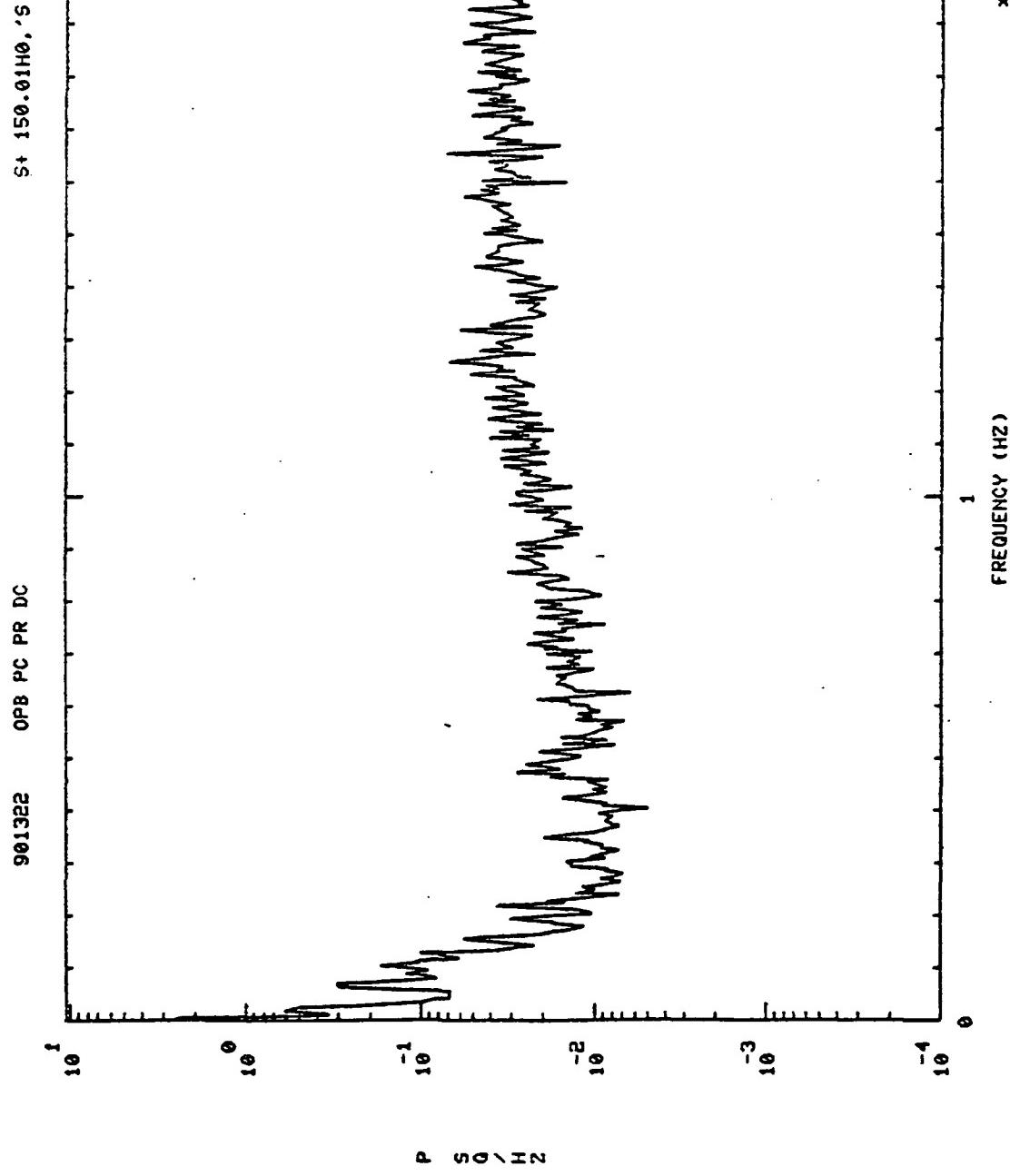


901322 OPB PC PR DC S+ 6.01H0.'S



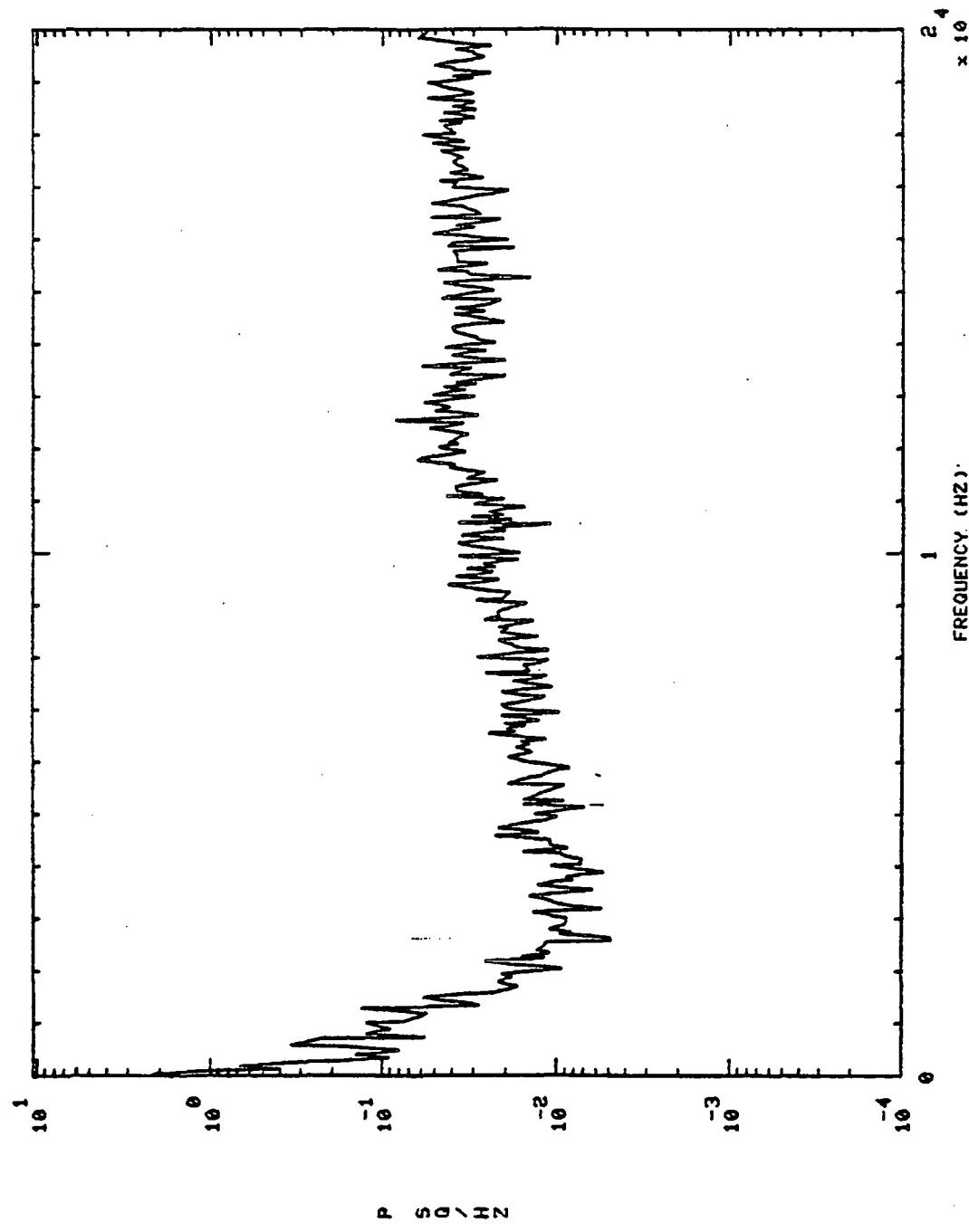
P S Q / HZ





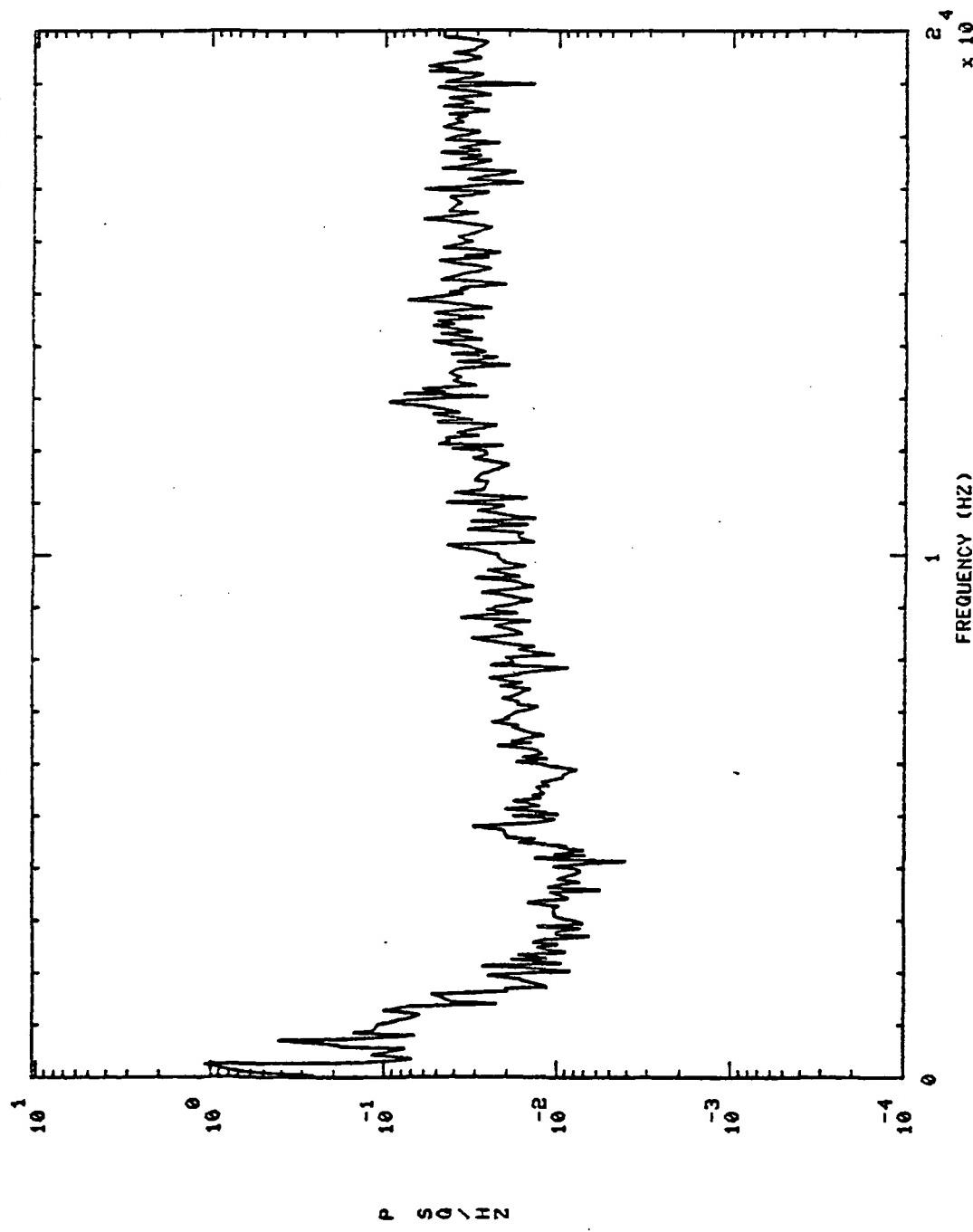
S+ 170.01Hz, 'S

901328 OPB PC PR DC



901322 OPB PC PR DC

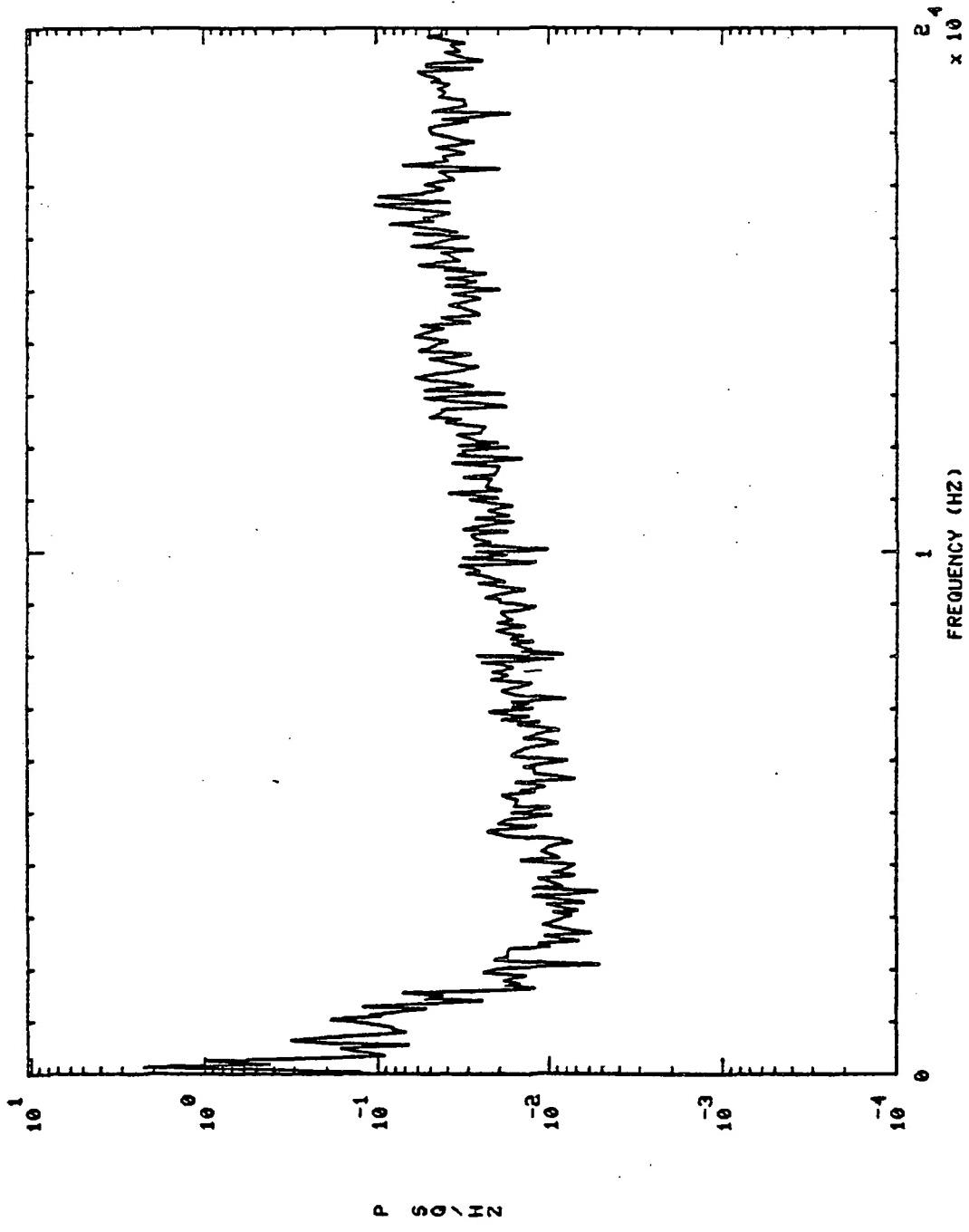
S+ 190.01Hz, S



S+ 210.01H0.'S

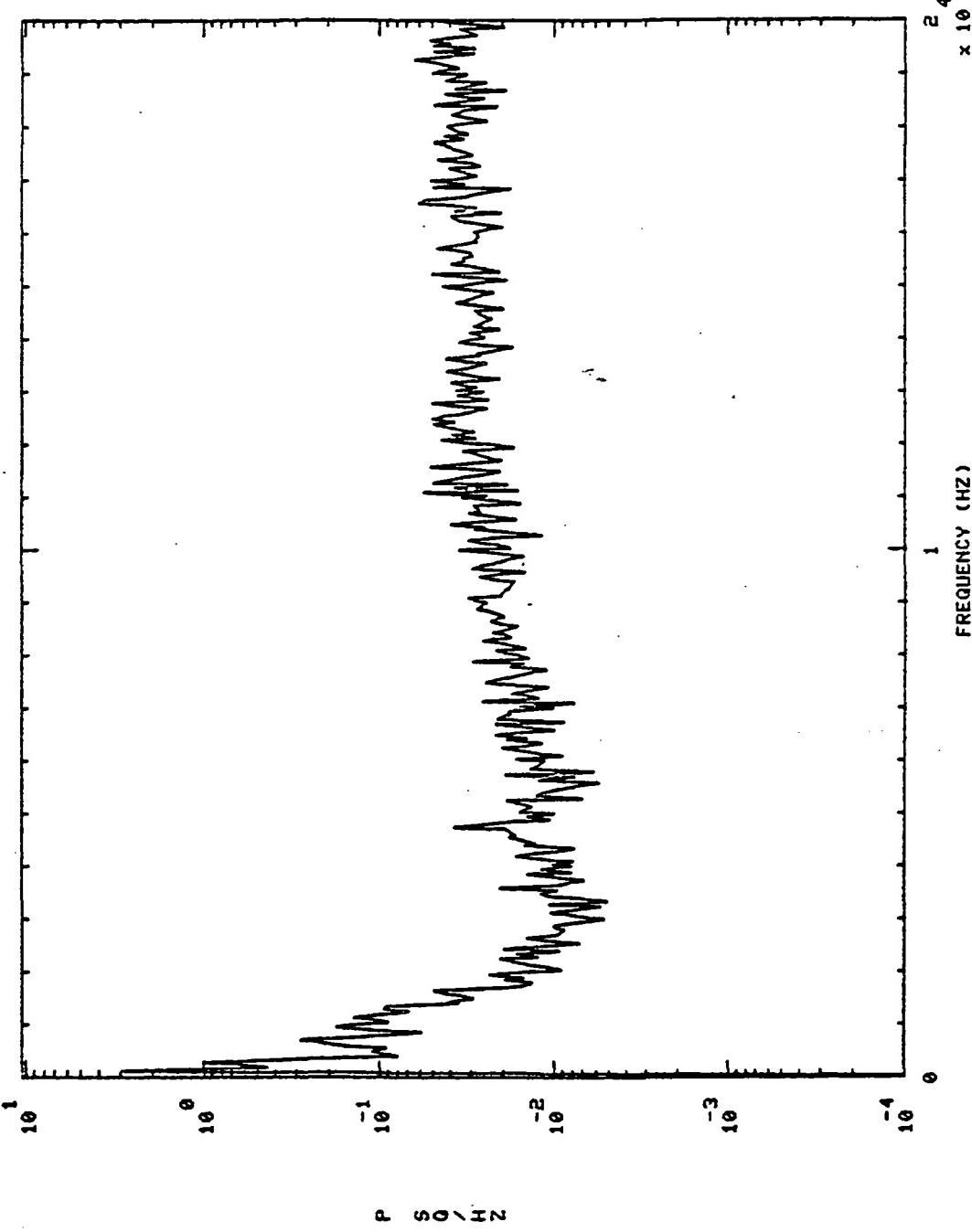
OPB PC PRR DC

961322



5+ 2330.01H0.'5

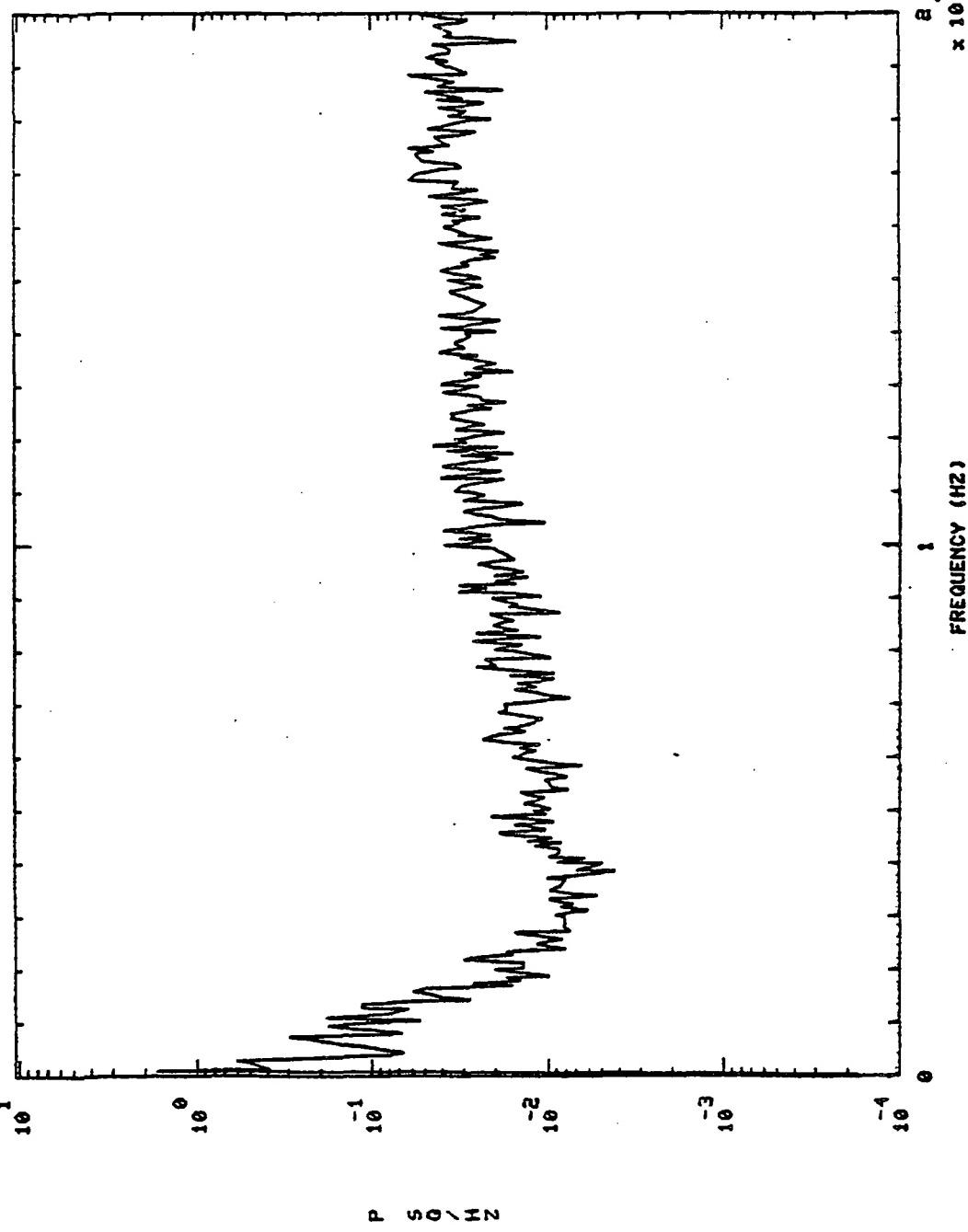
901322 OFB PC PR DC



S + 260.01H0.'S

OPB PC PR DC

901322

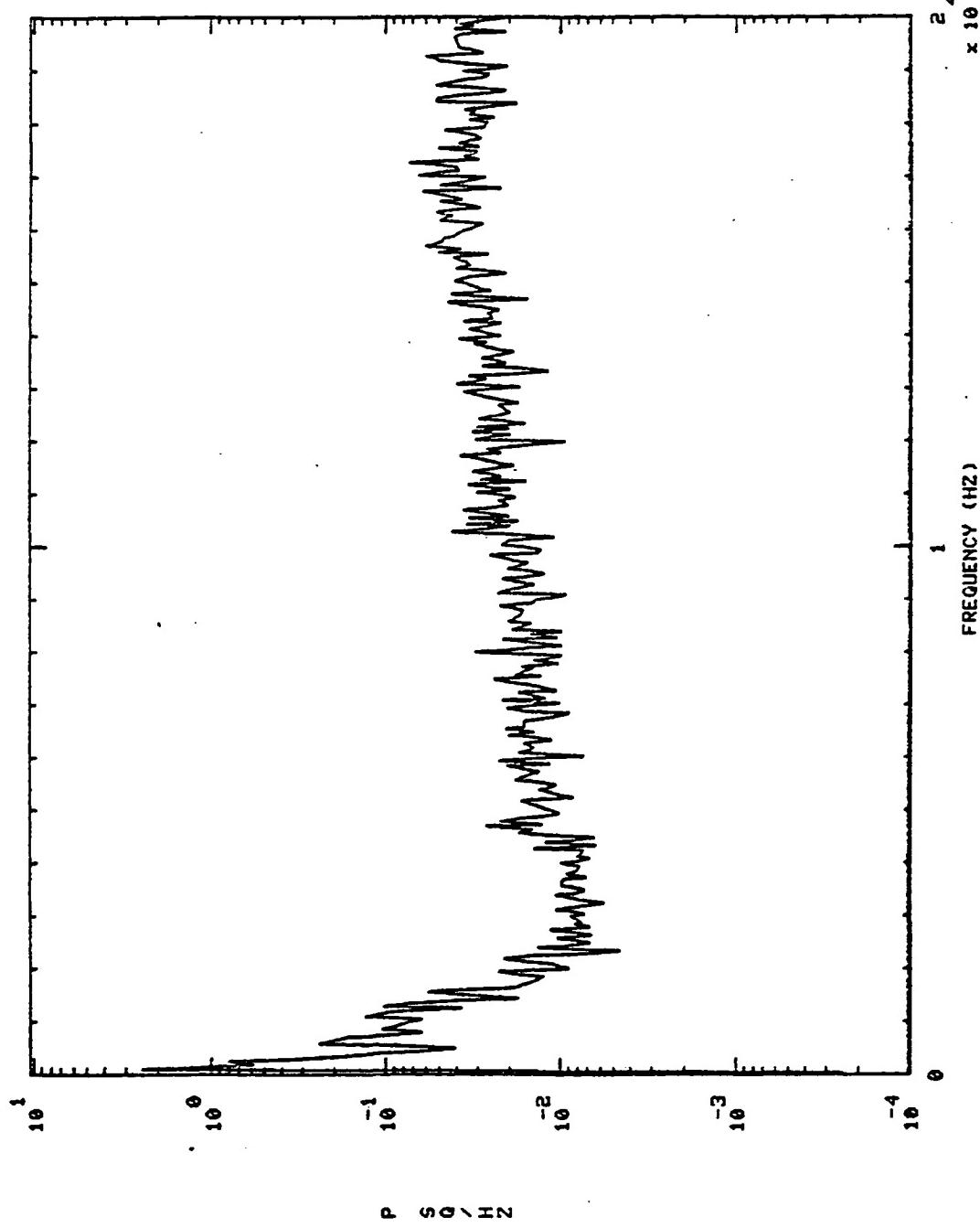


P
S
C / Hz

S+ 280.01Hz /s

OPB PC PR DC

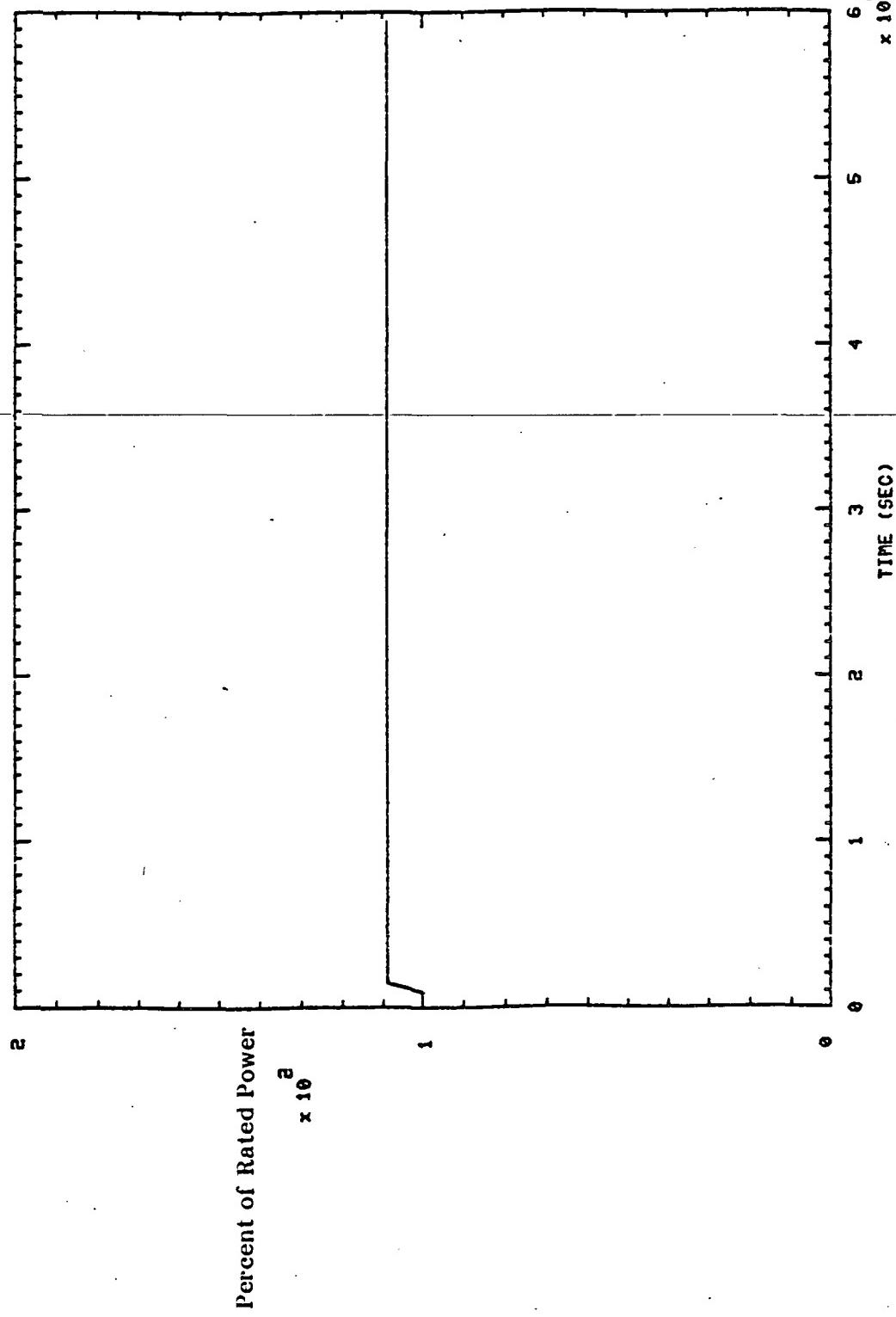
901322

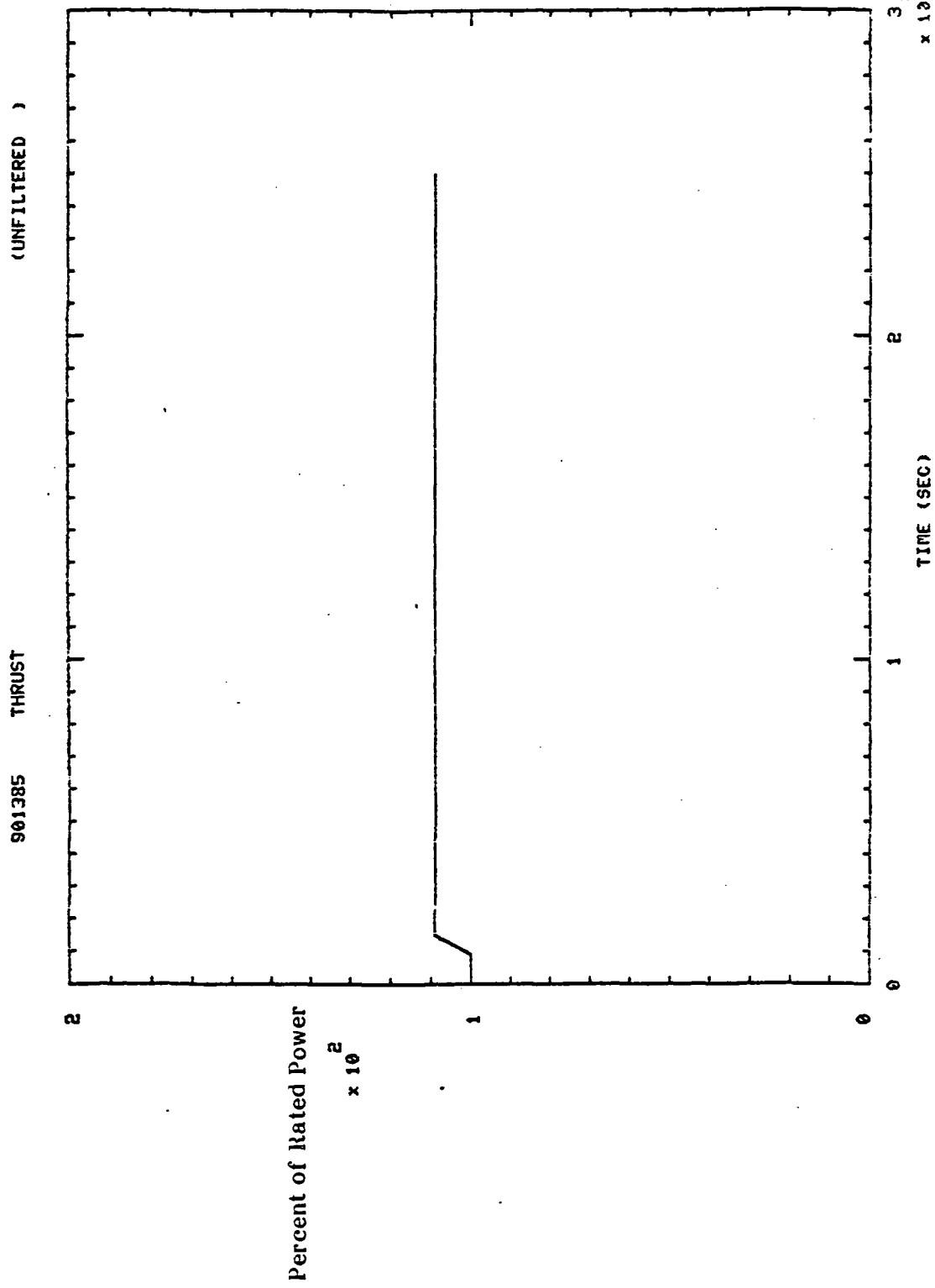


(UNFILTERED)

THRUST

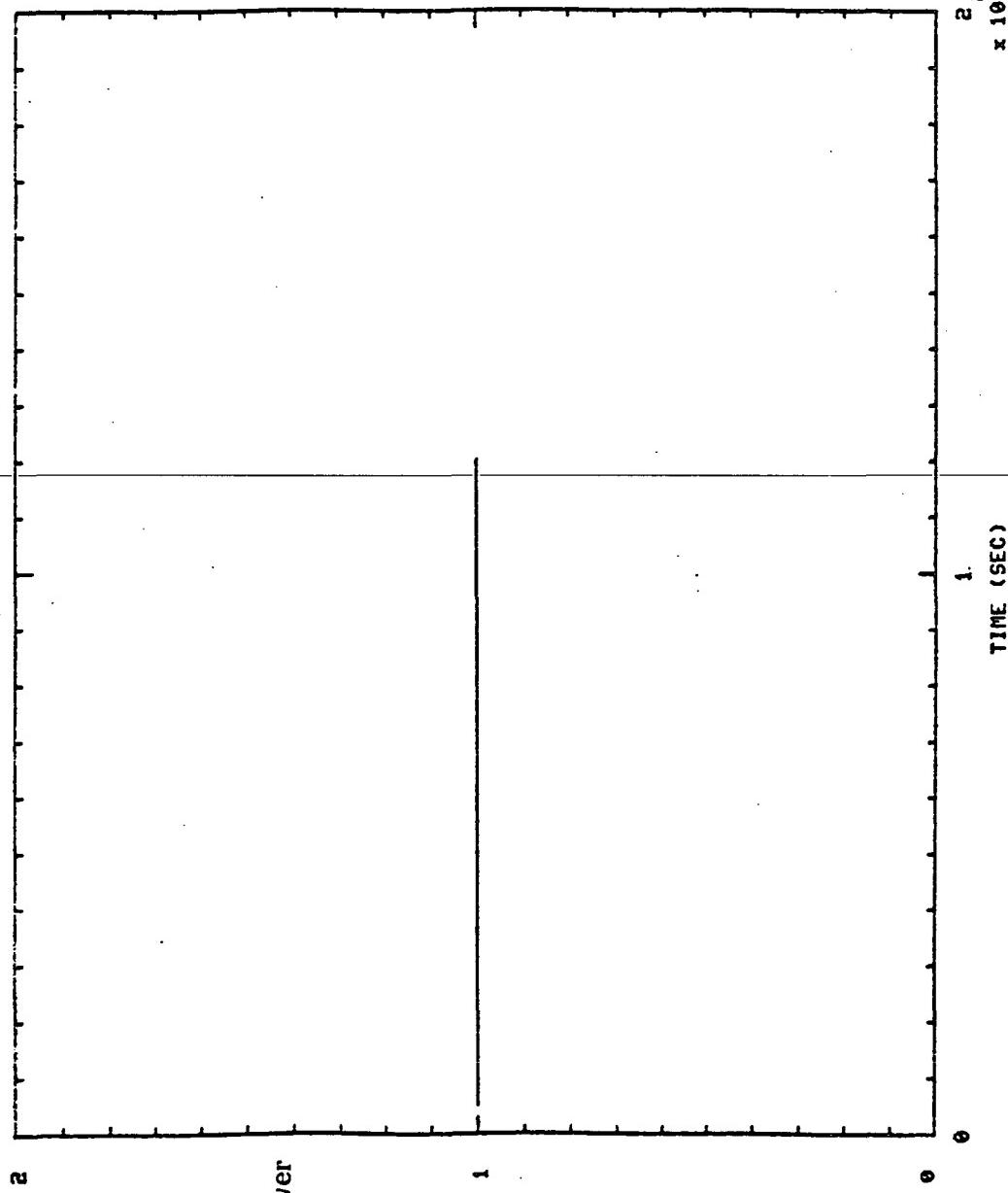
901384





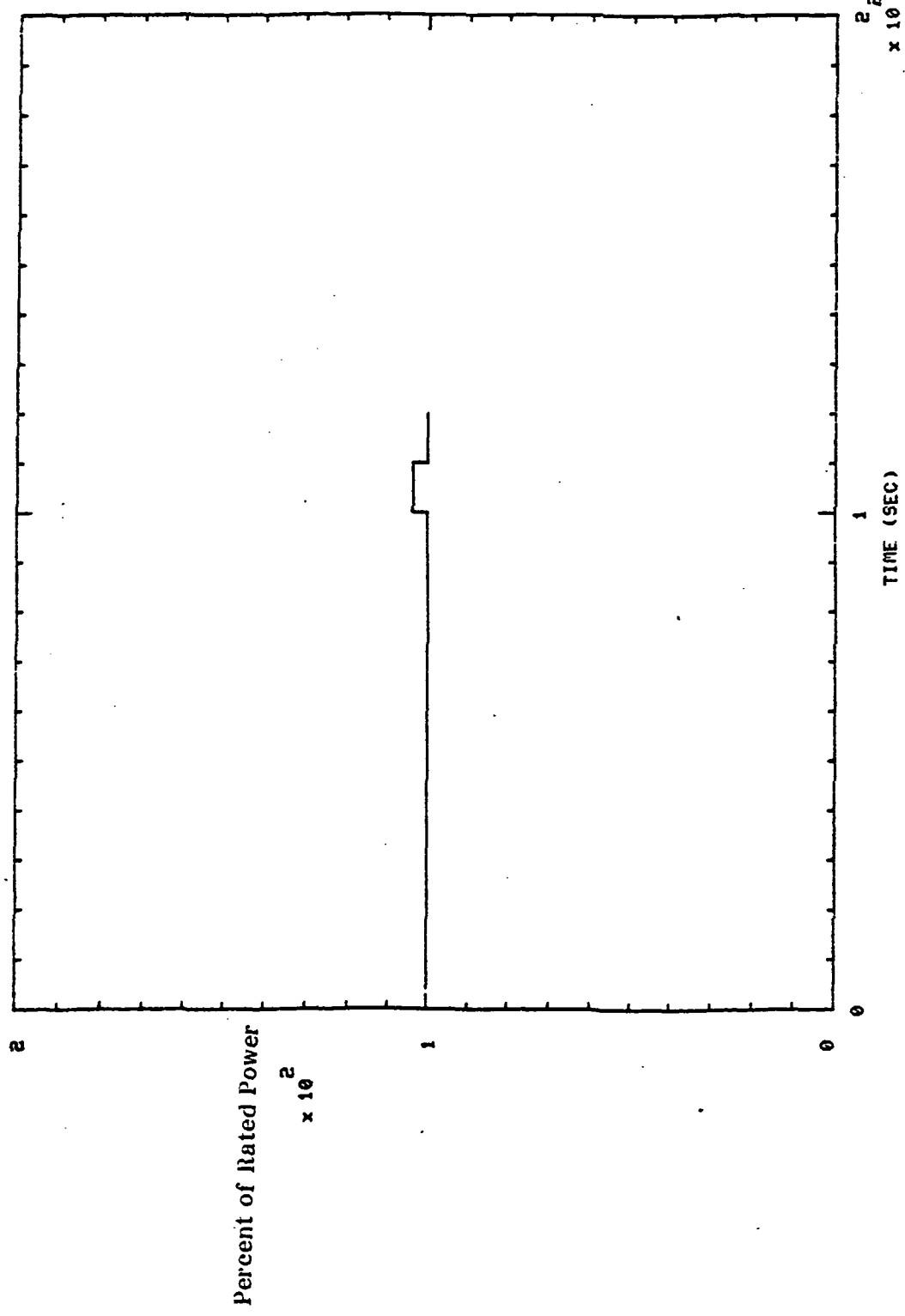
(UNFILTERED)

901388 THRUST

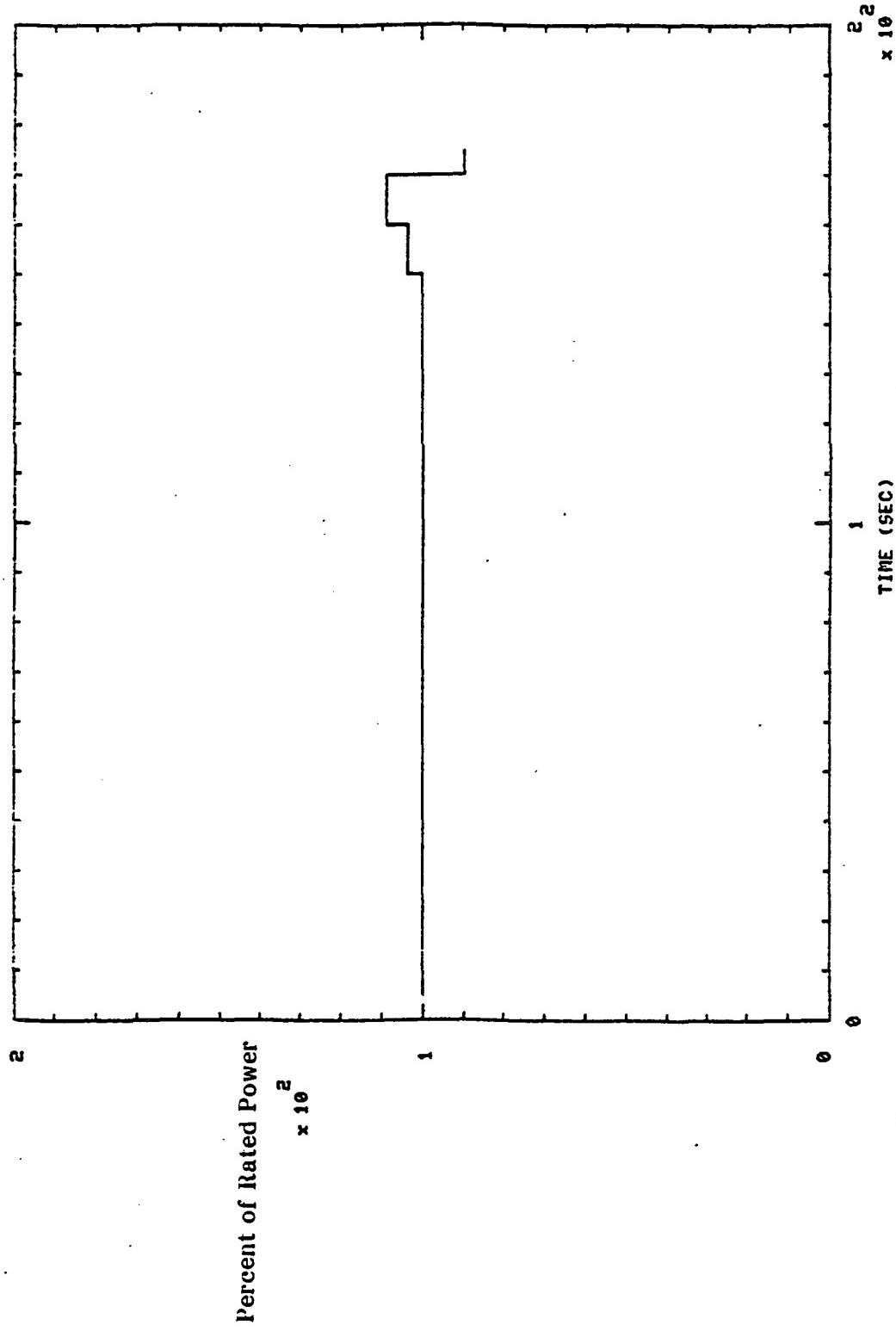


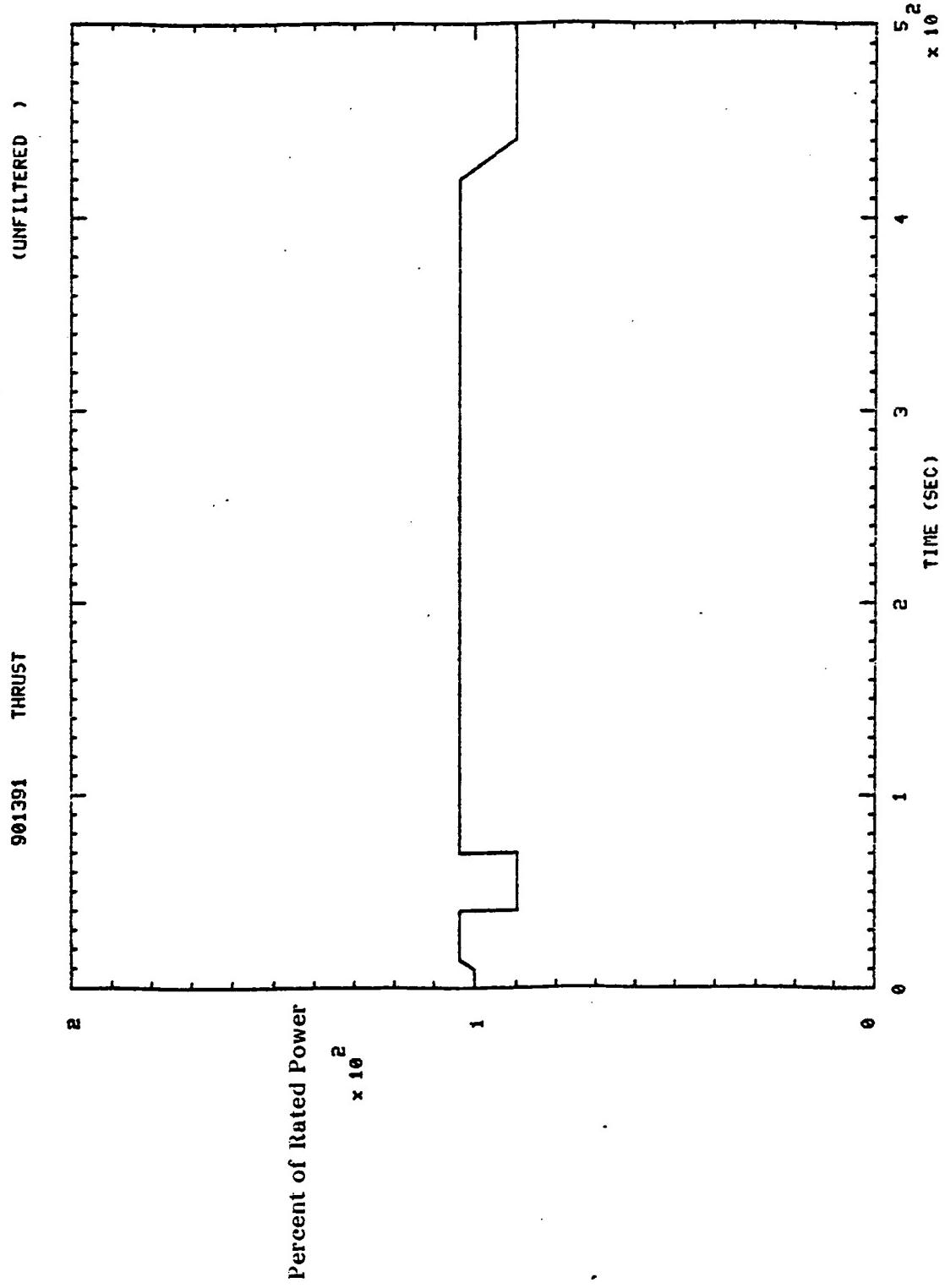
(UNFILTERED)

901389 THRUST



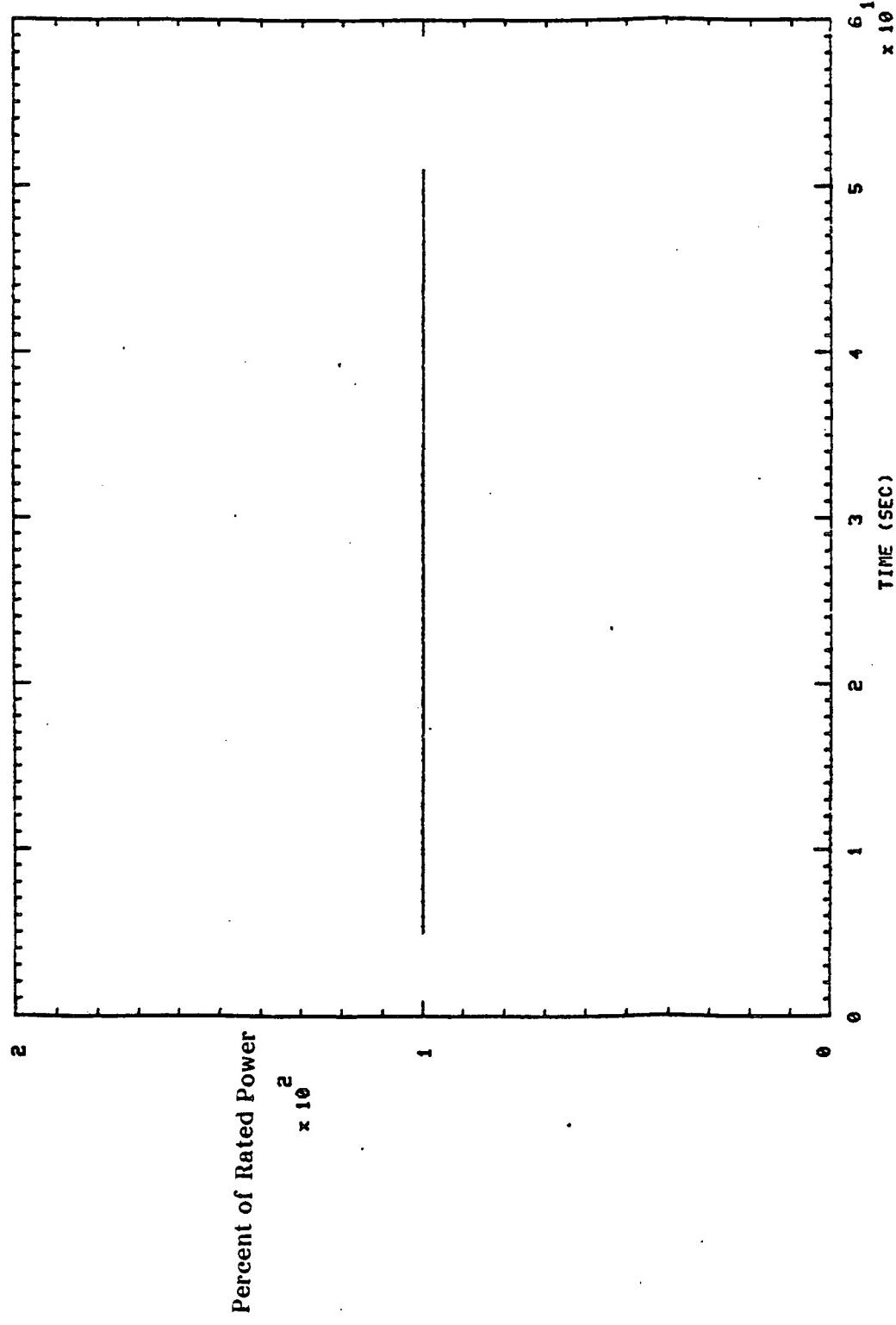
901390 THRUST (UNFILTERED)





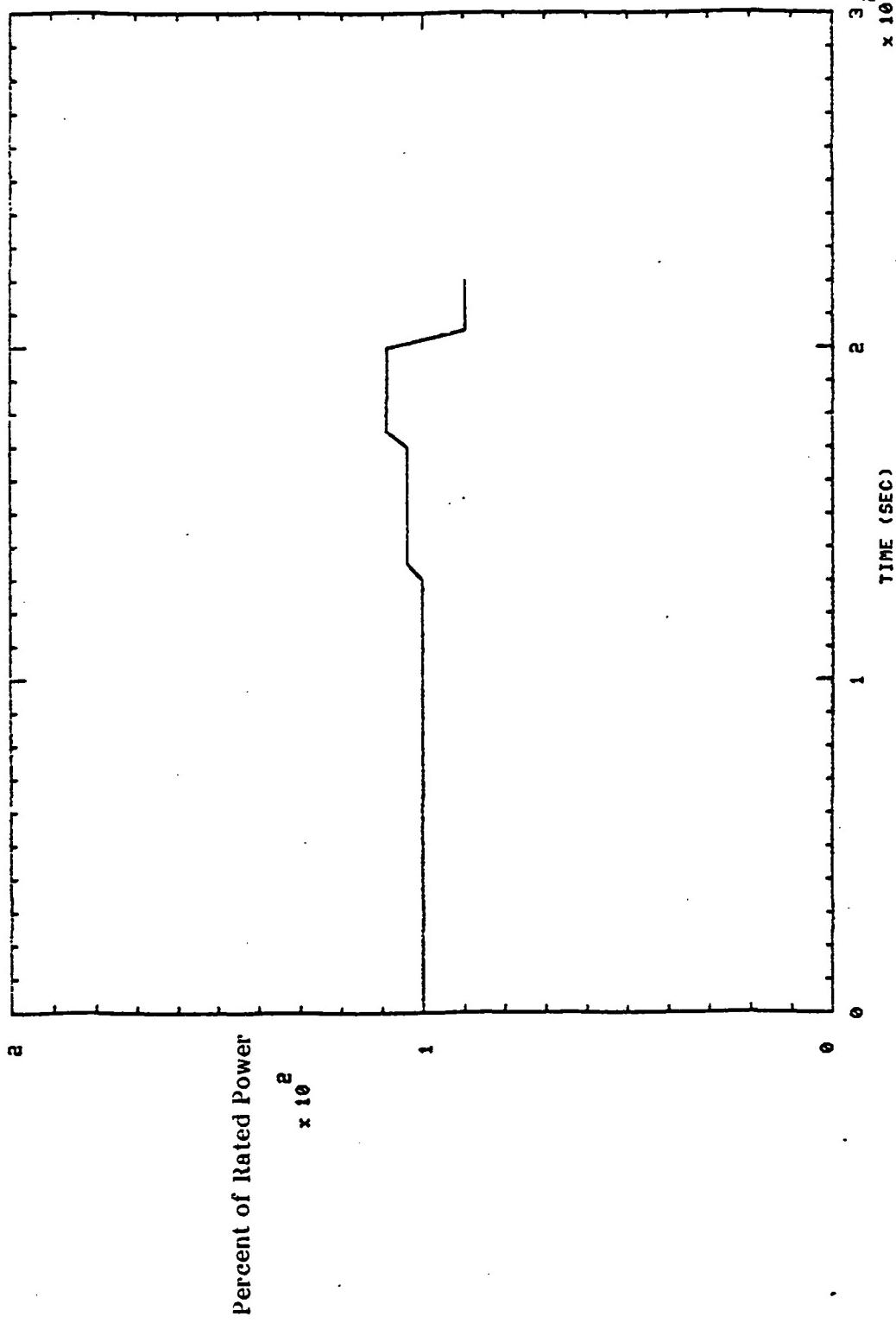
901393 THRUST

(UNFILTERED)



901394 THRU₃

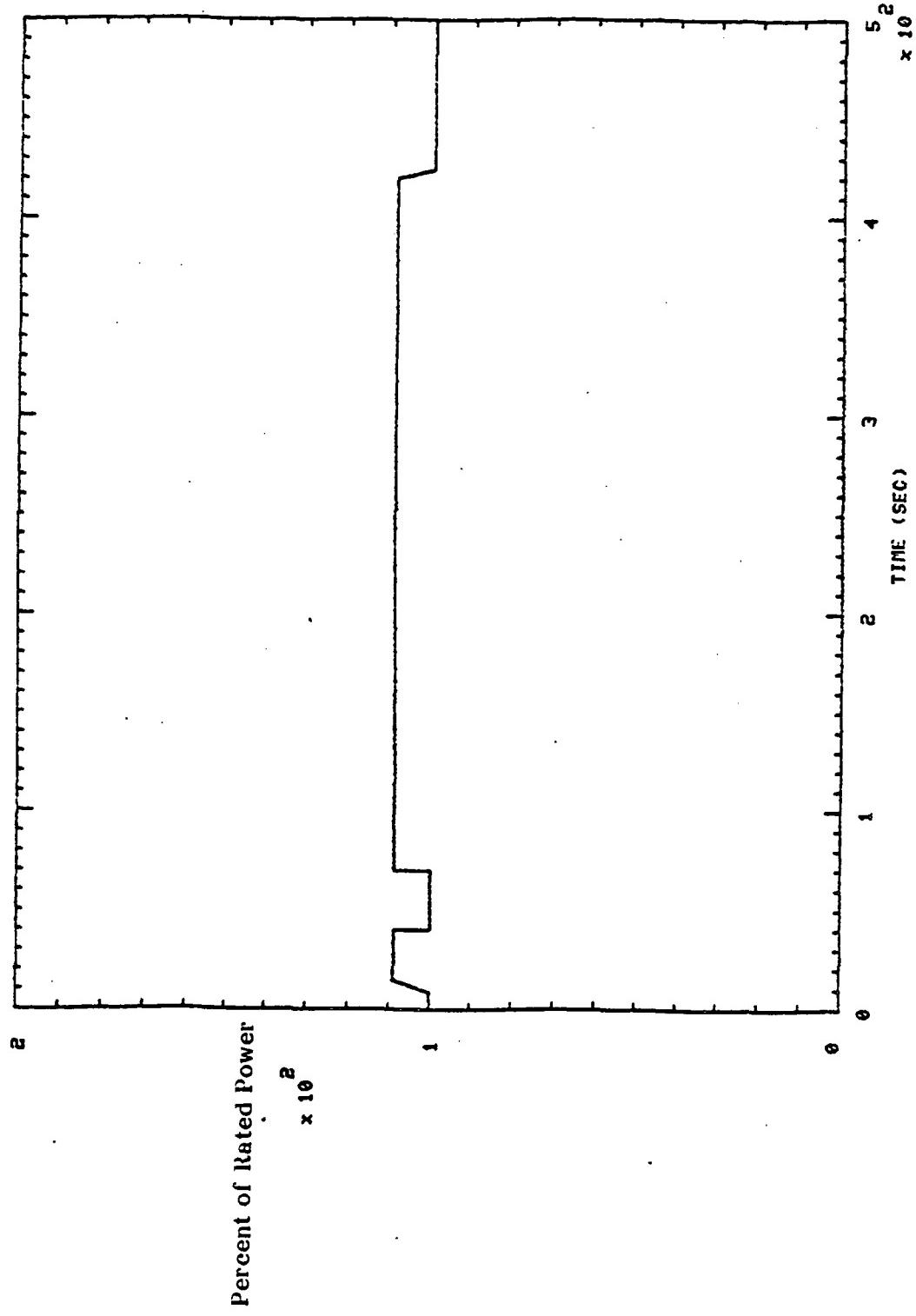
(UNFILTERED)

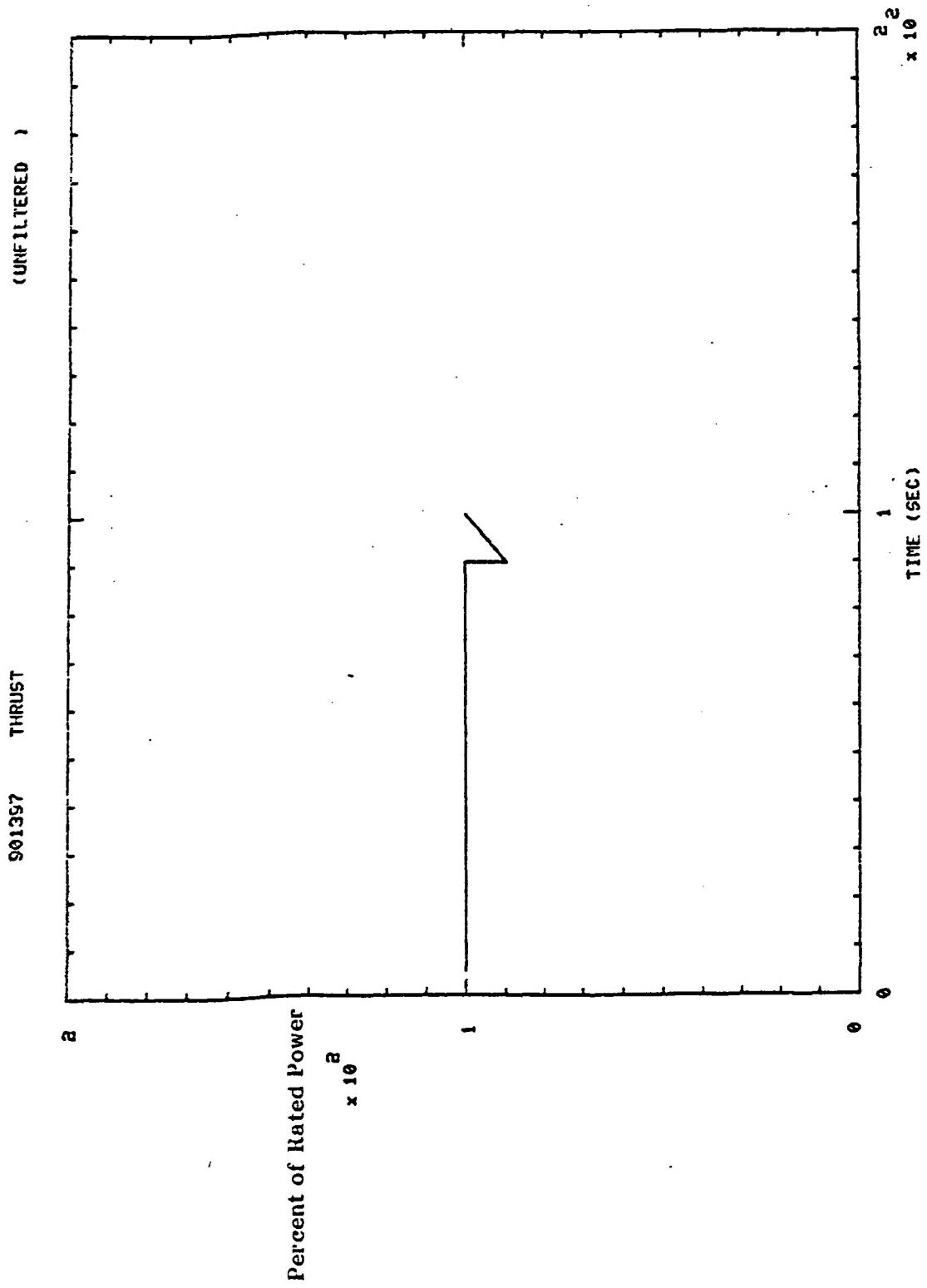


901395

(UNFILTERED)

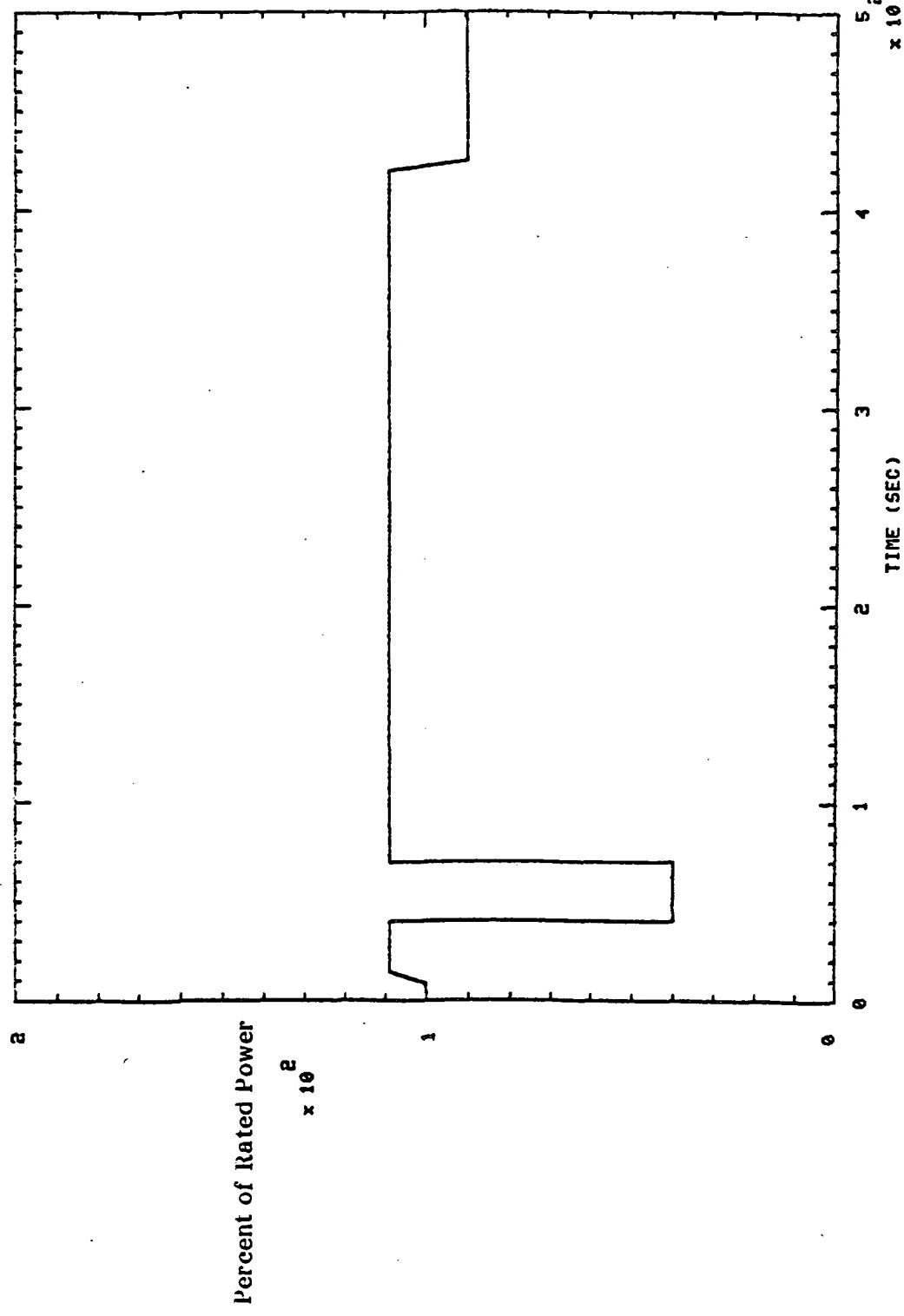
THRUST

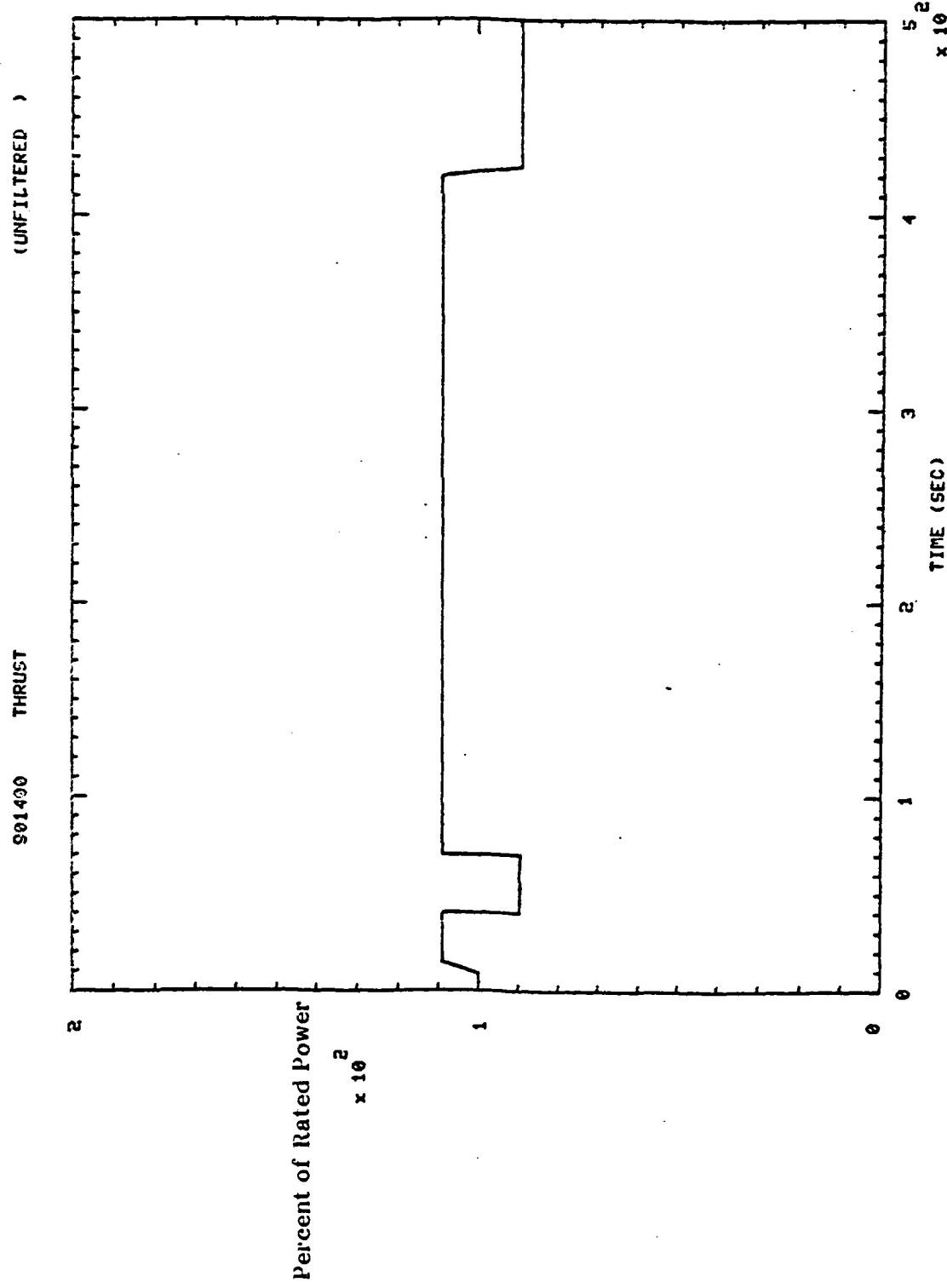




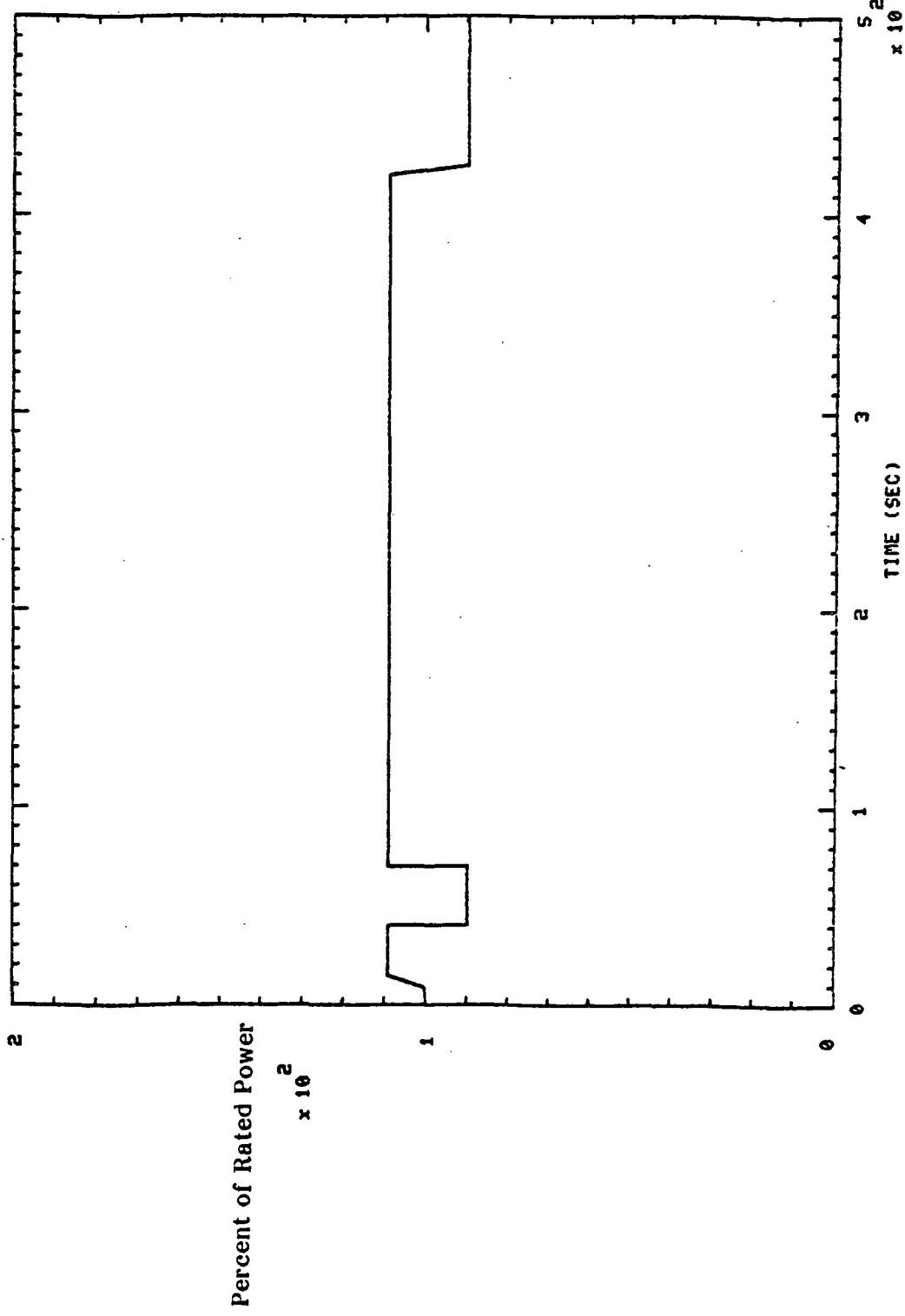
(UNFILTERED)

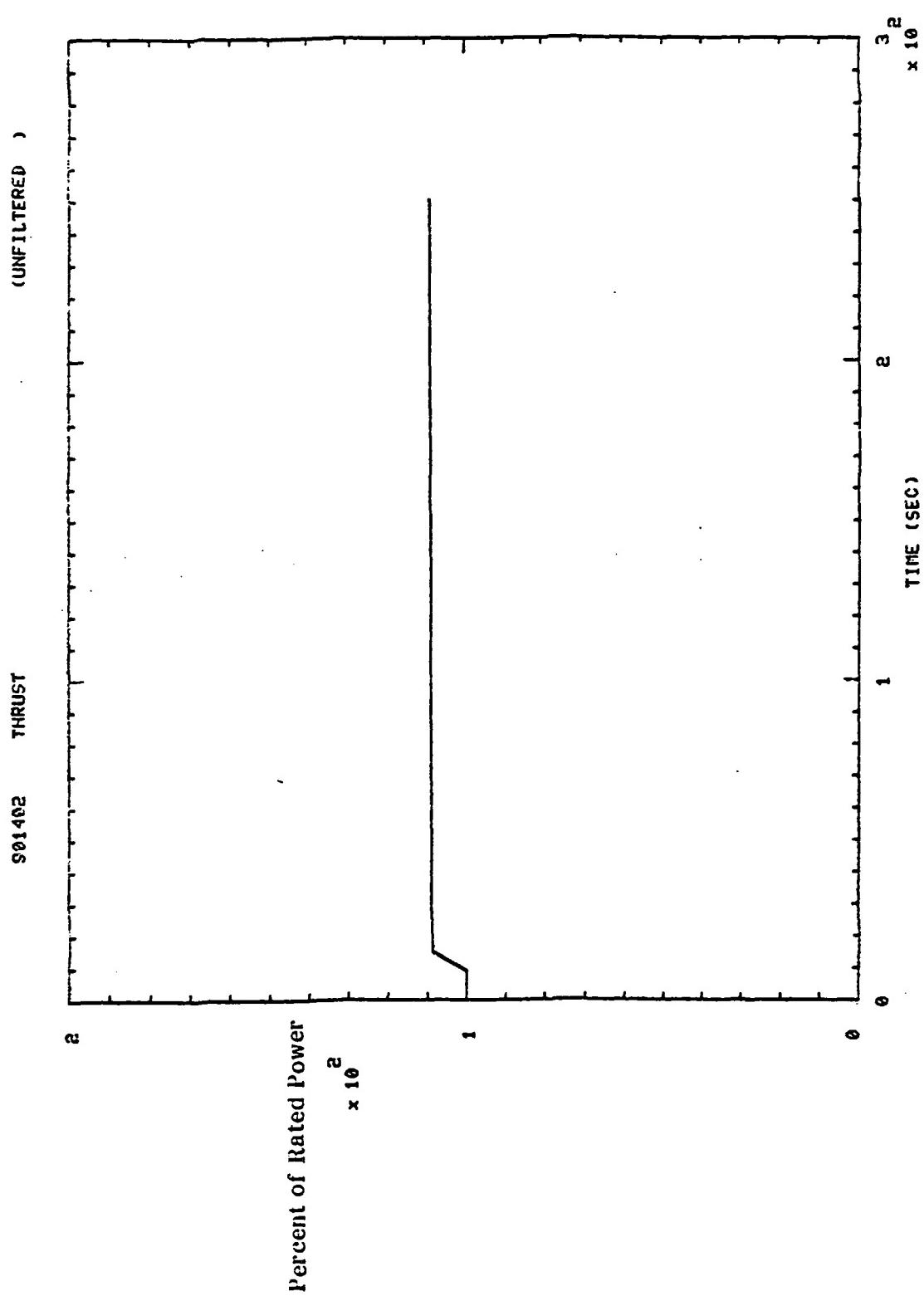
901398 THRUST



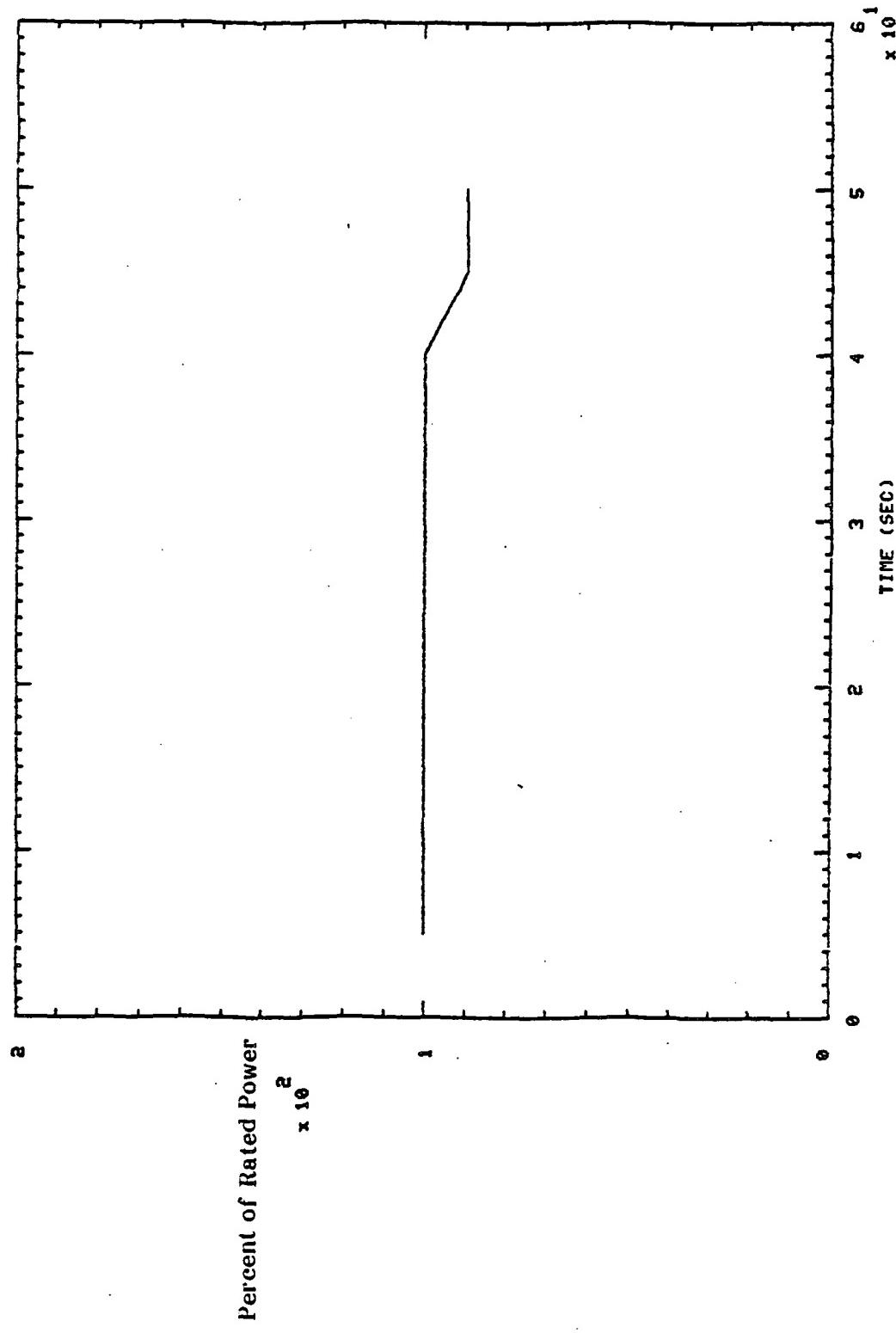


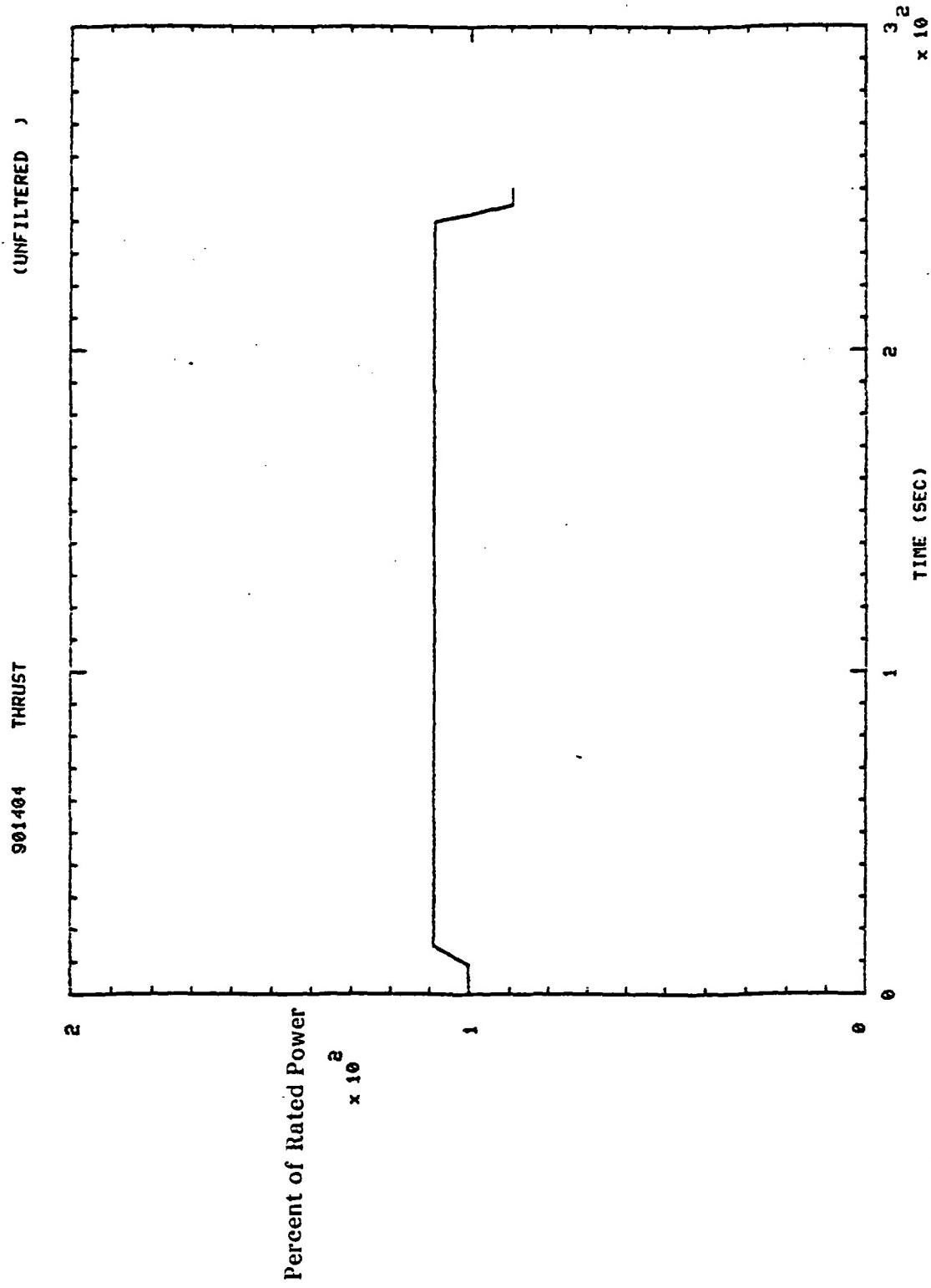
901401 THRUST (UNFILTERED)



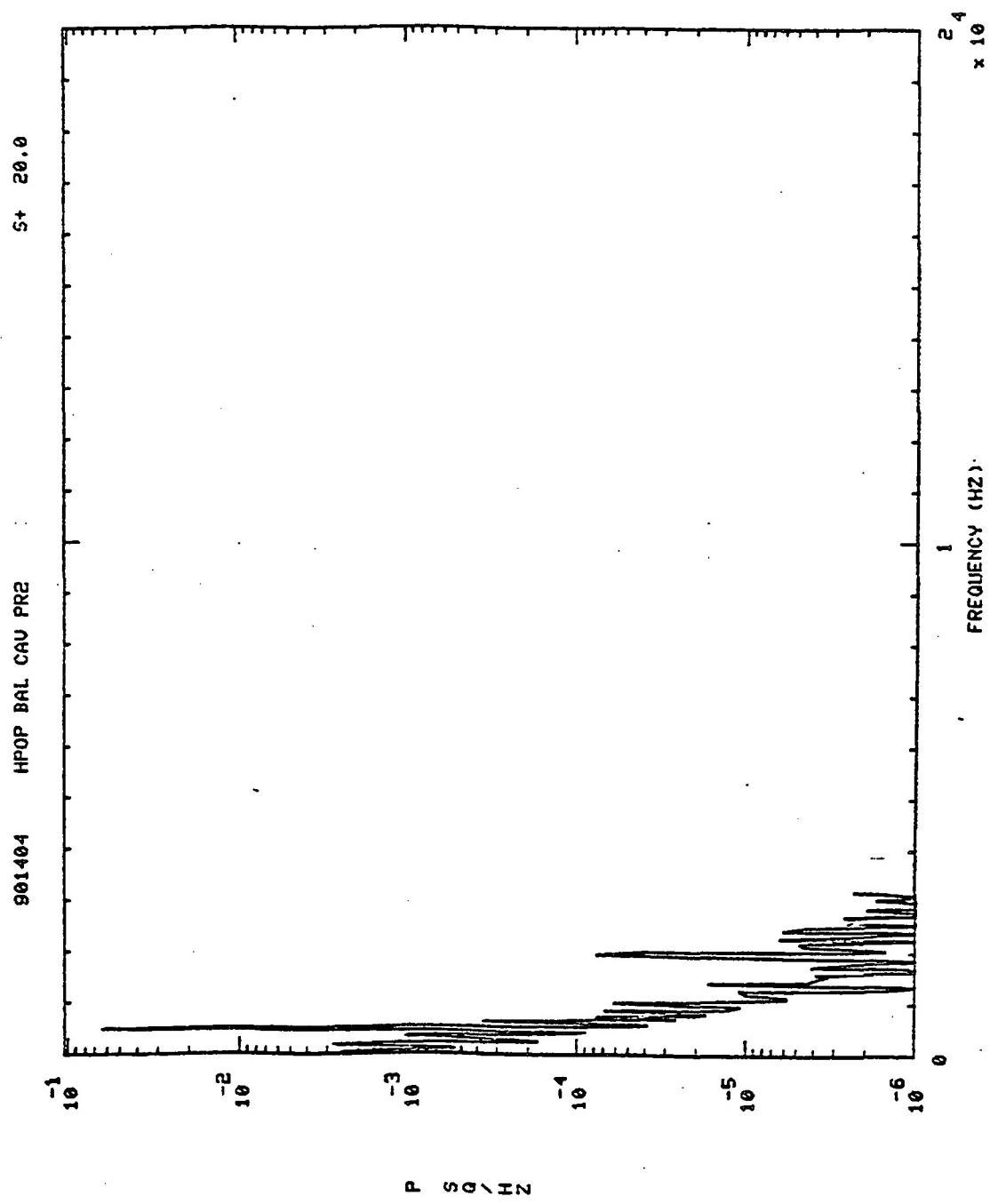


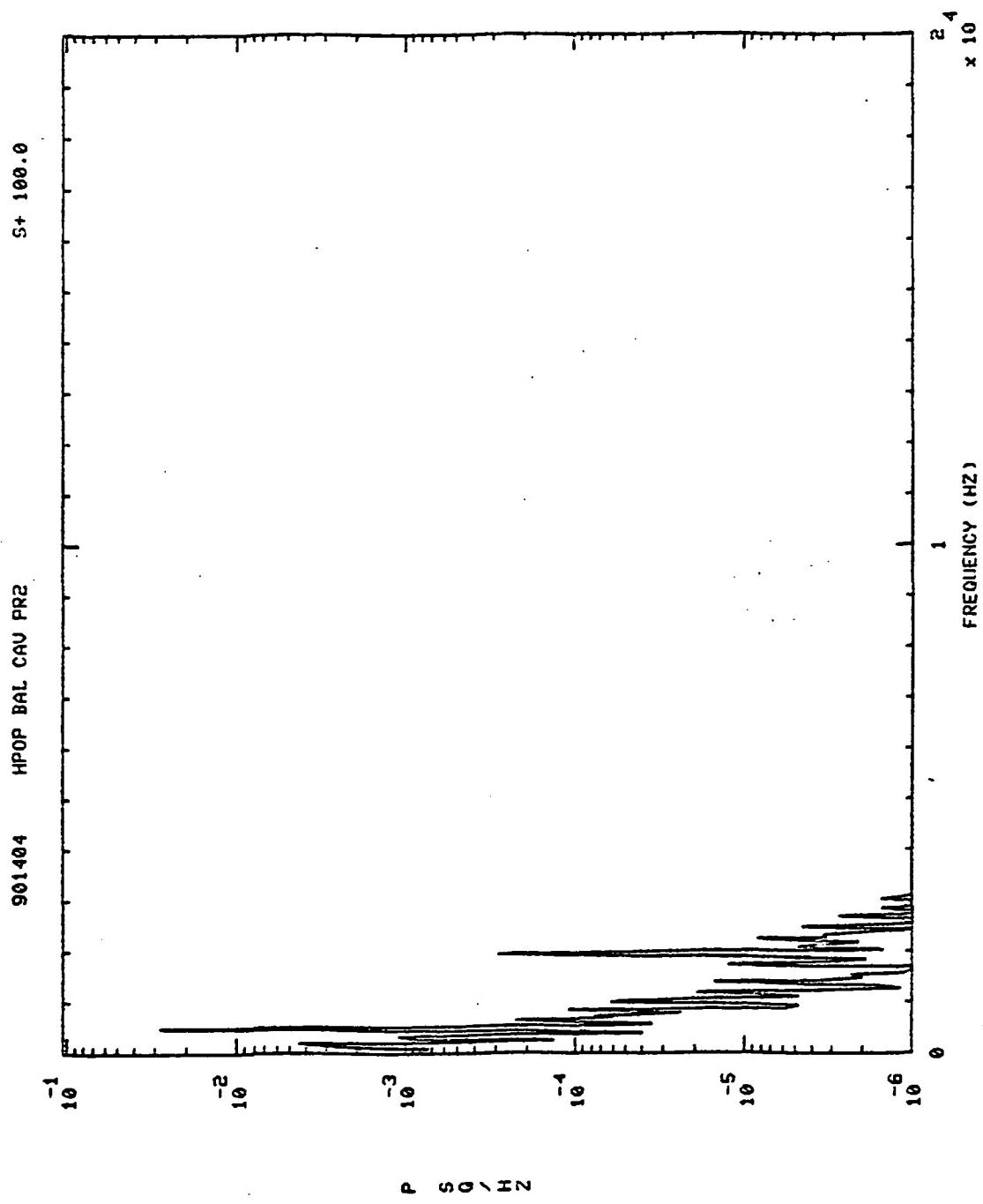
901403 THRUST (UNFILTERED)





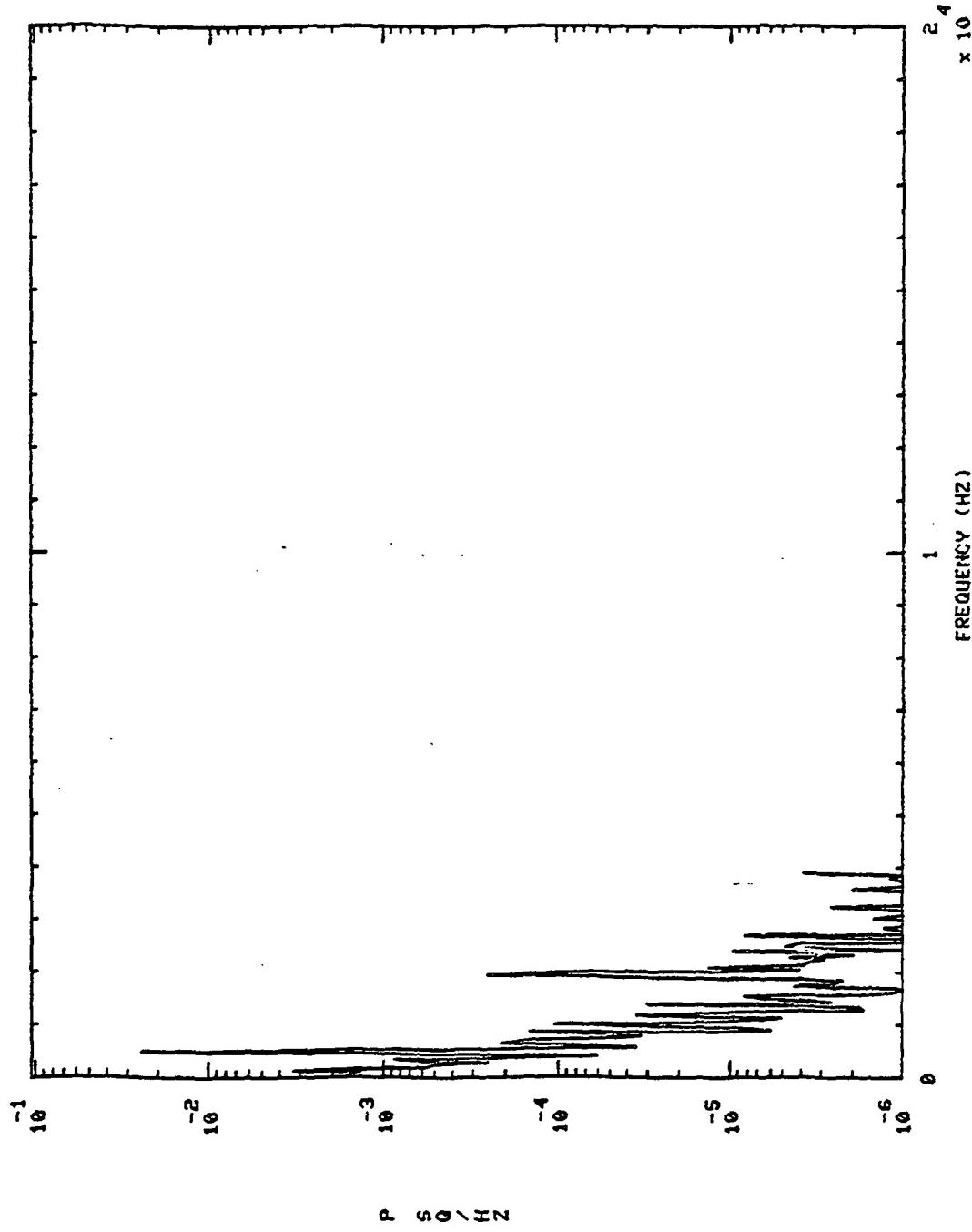
961404 HPOP BAL CAV PR2

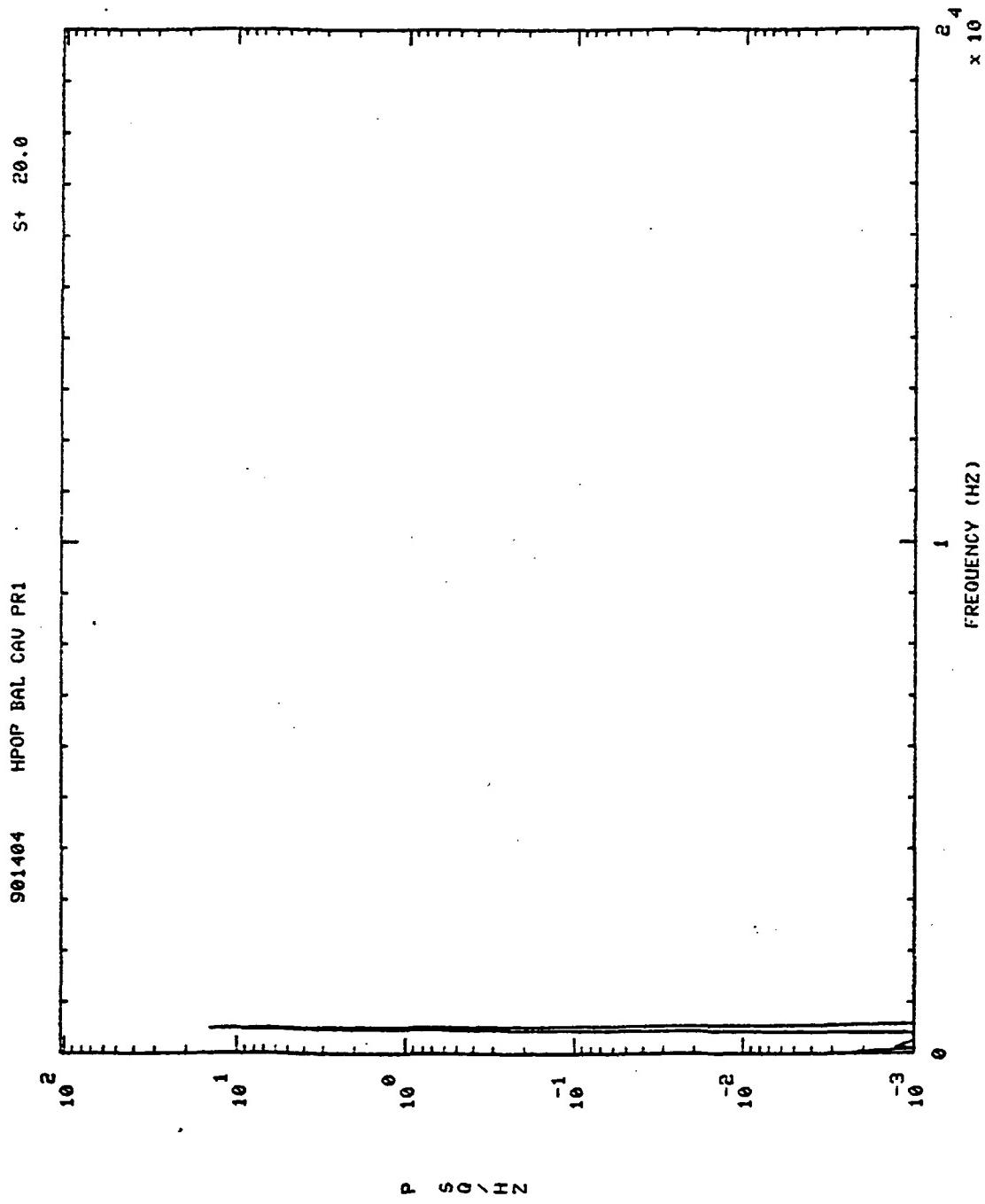




S+ 220.0

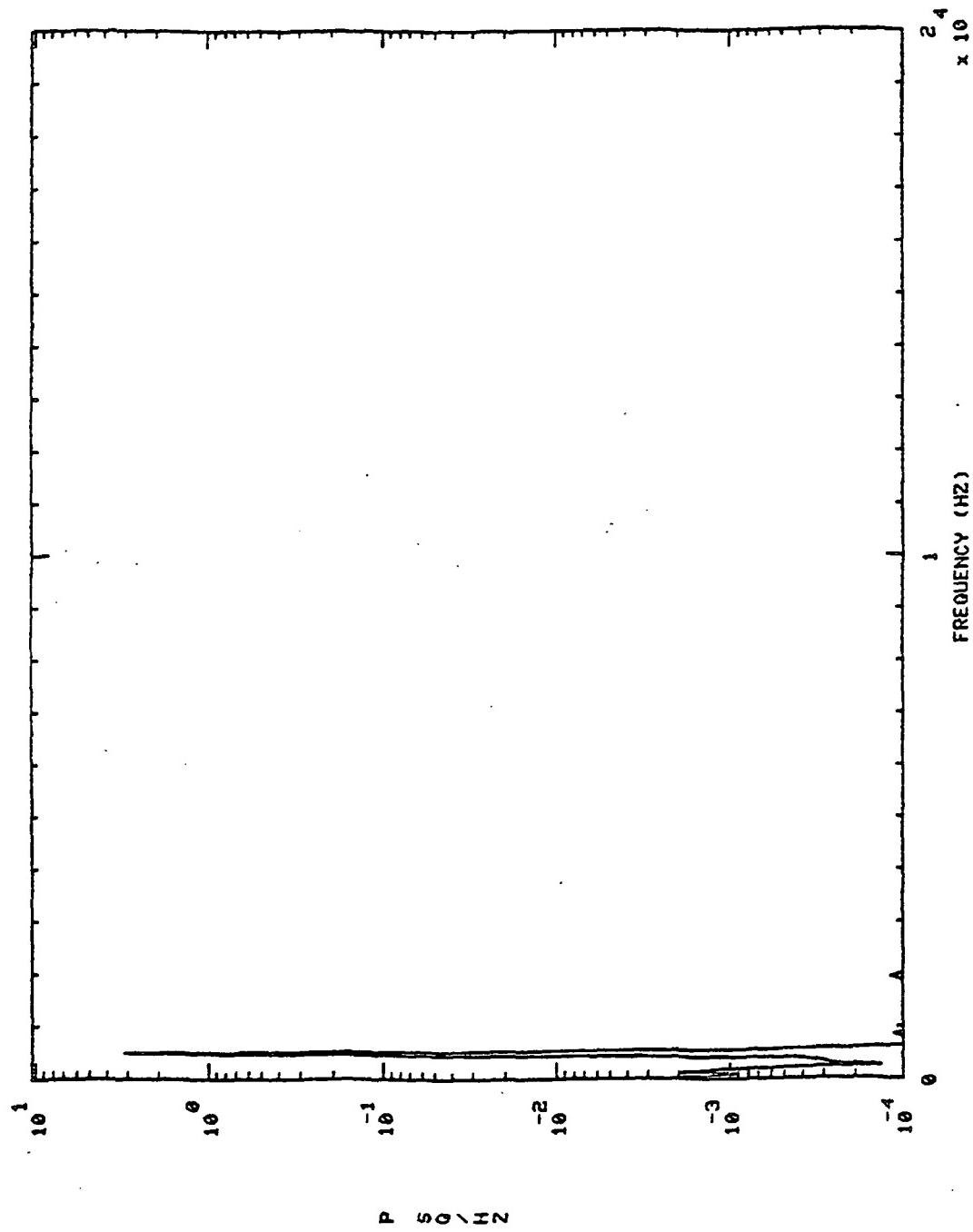
901404 HPOP BAL CAV PR2

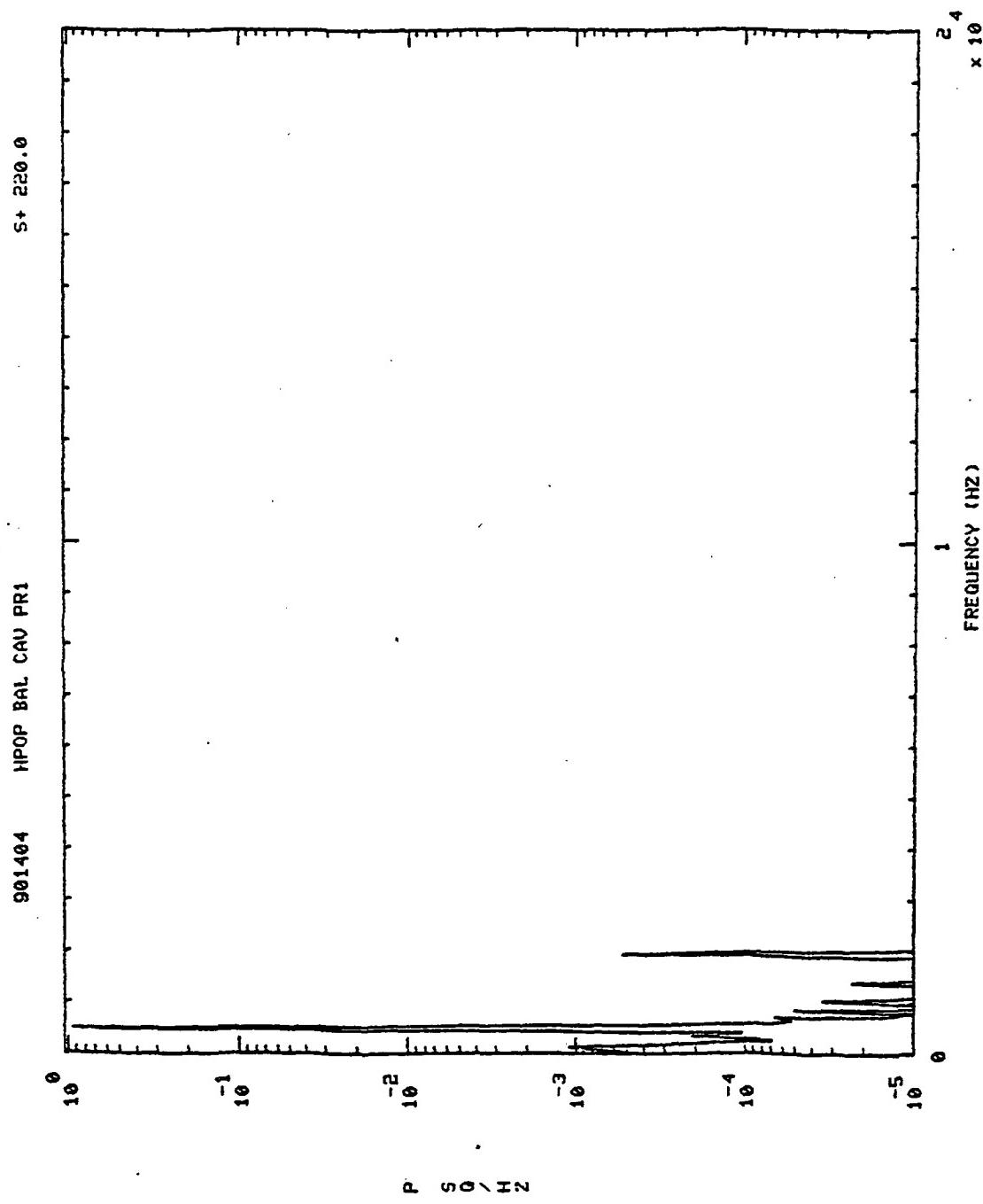




901404 HPOP BAL CAV PR1

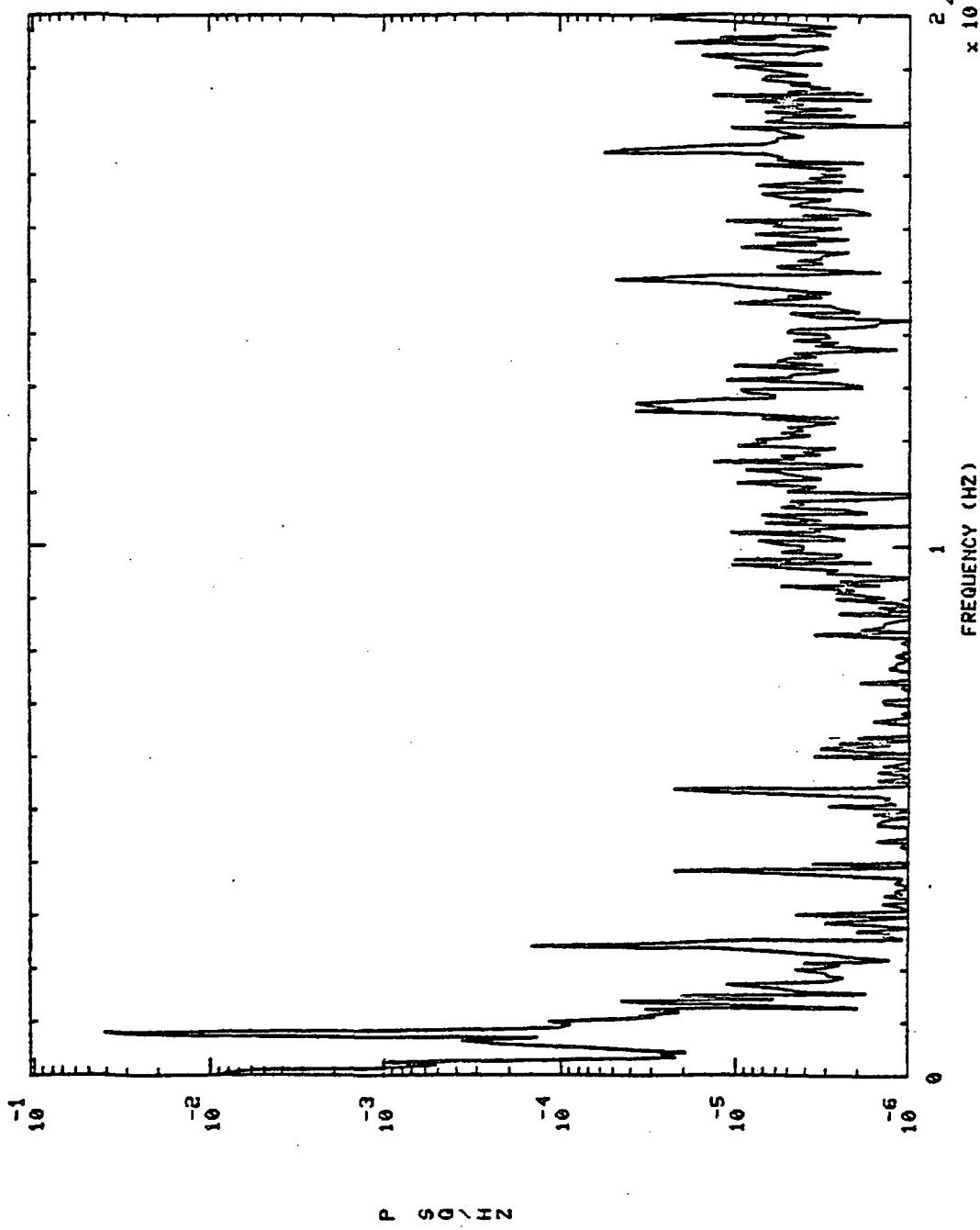
S+ 100.0



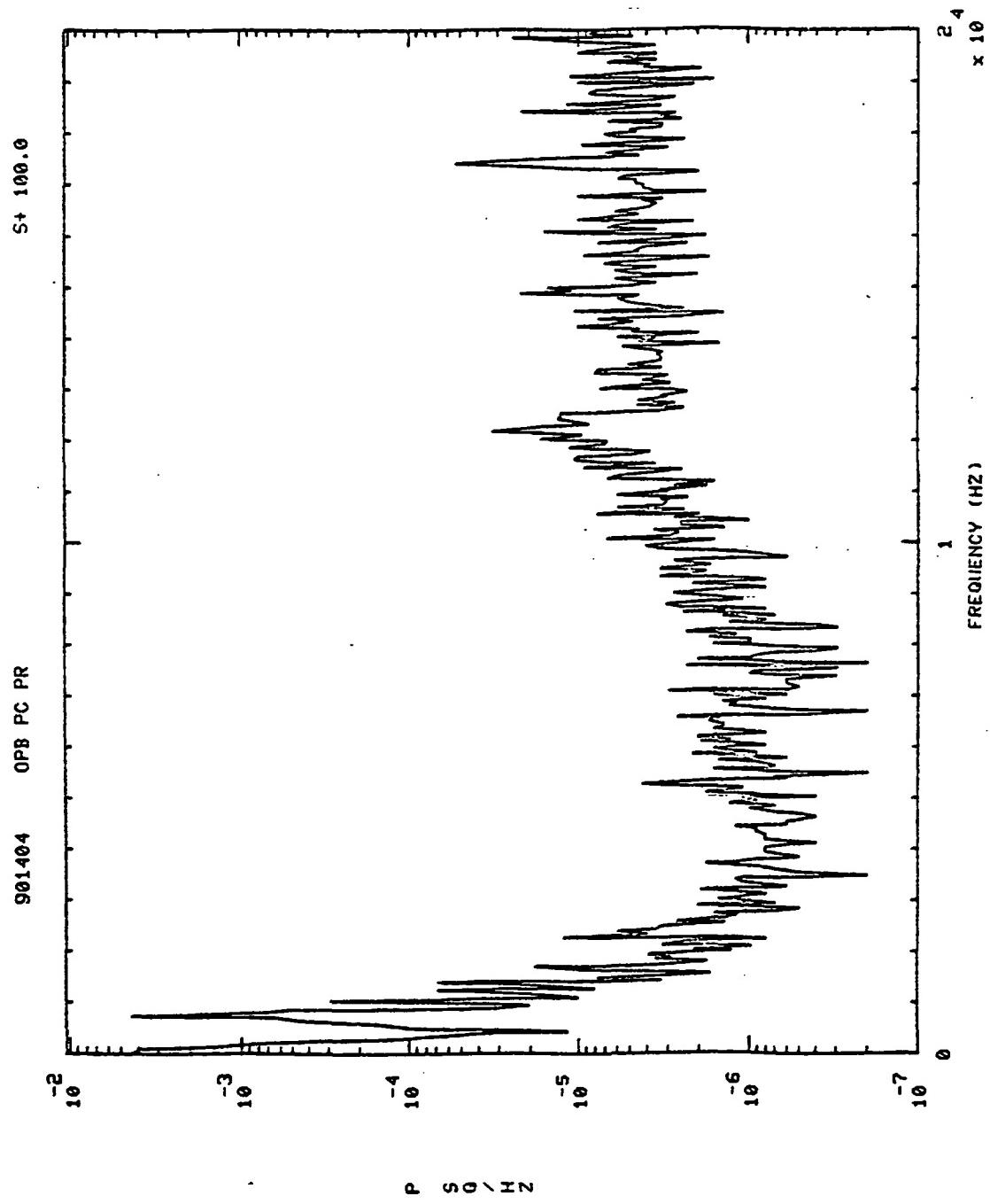


S+ 20.0

901404 QPB PC PR

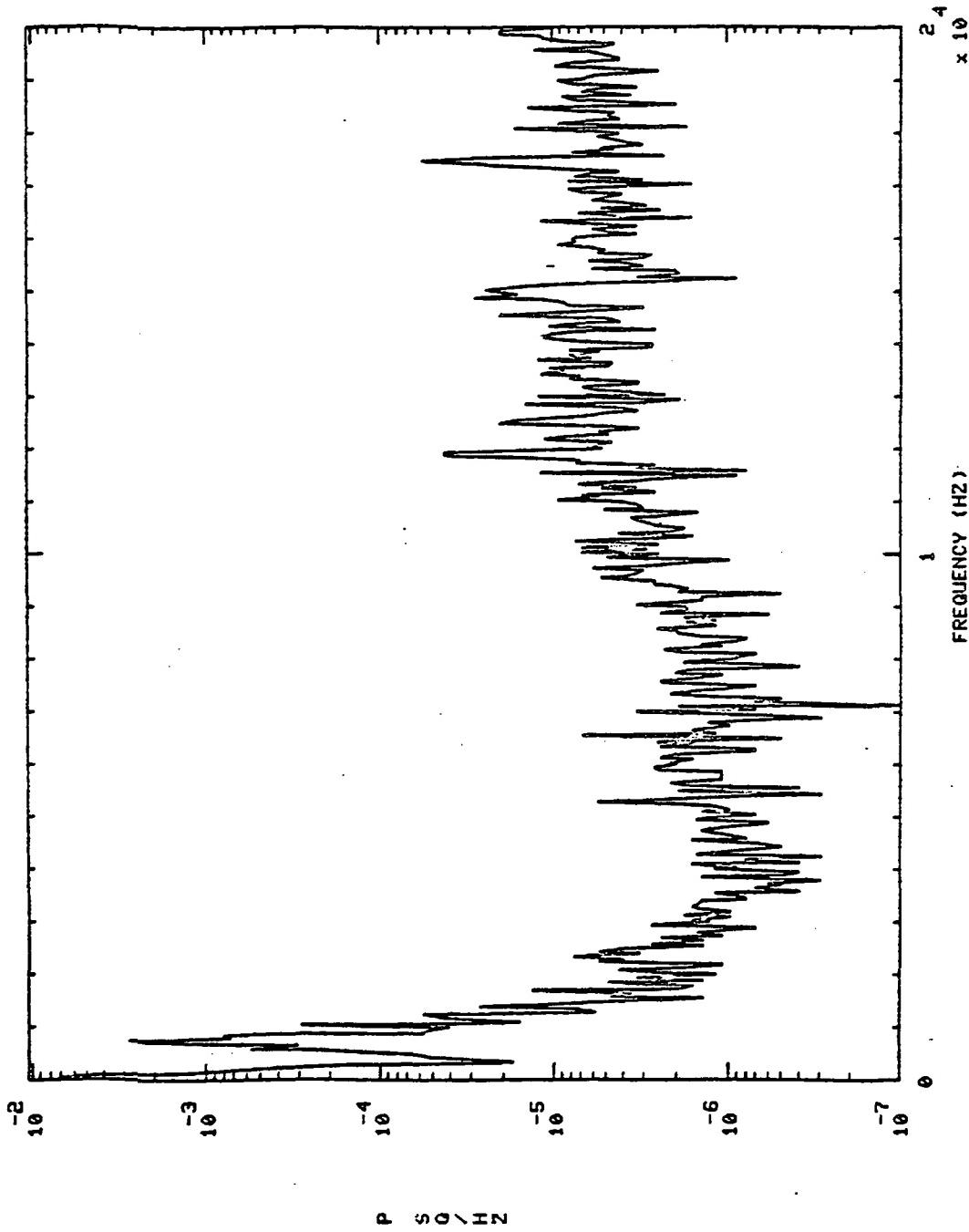


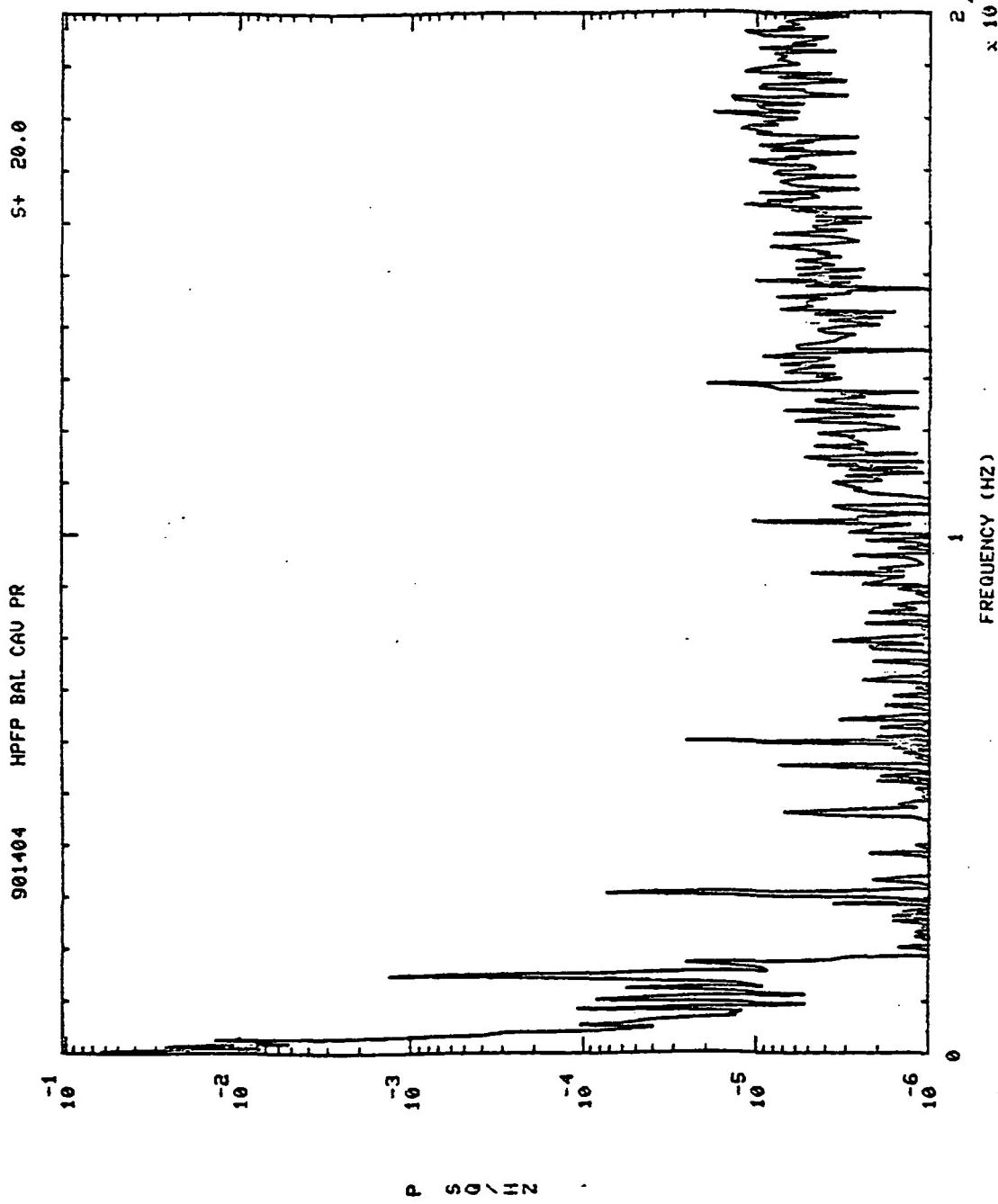
P S Q / HZ



901404 OPB PC PR

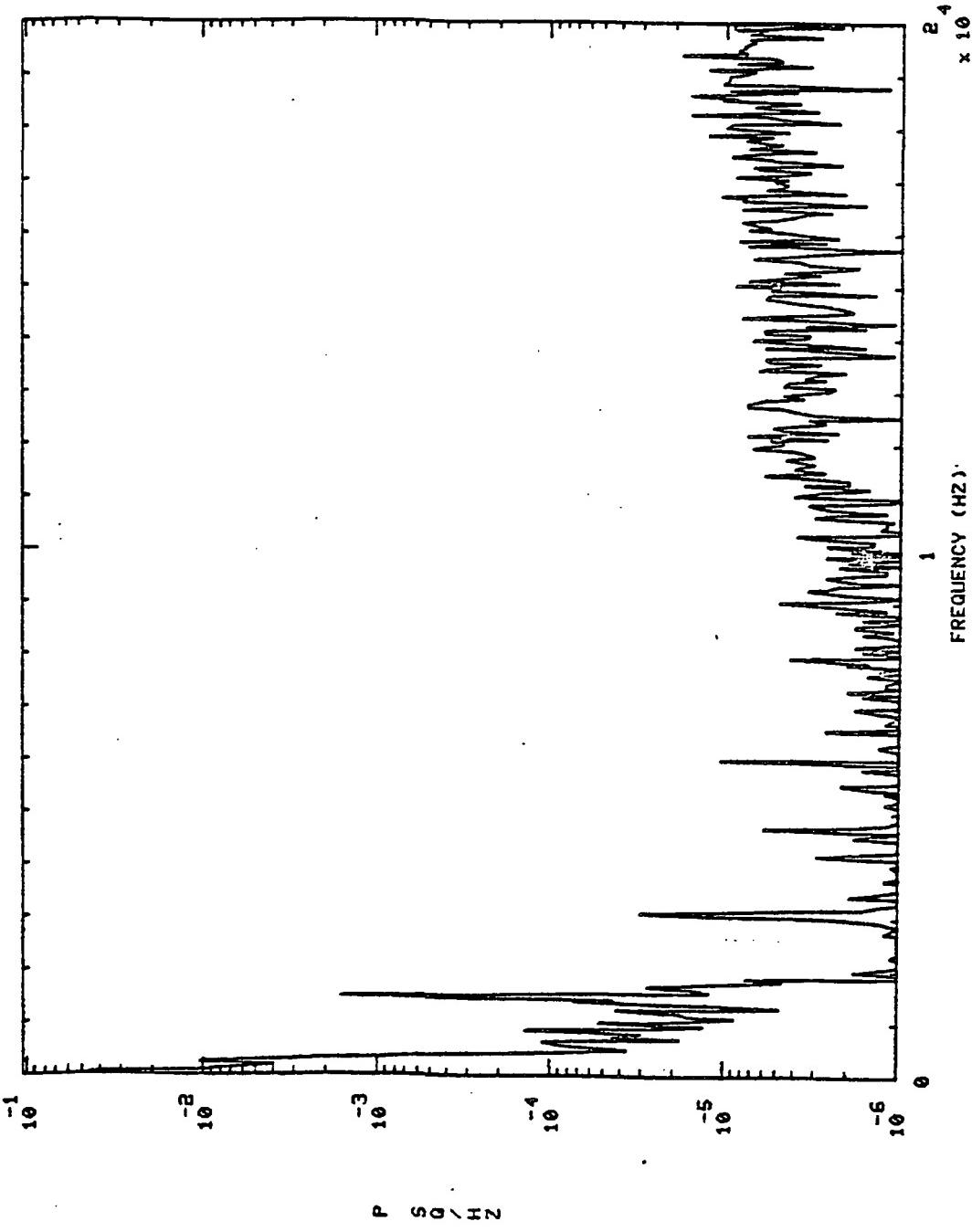
S+ 220.0

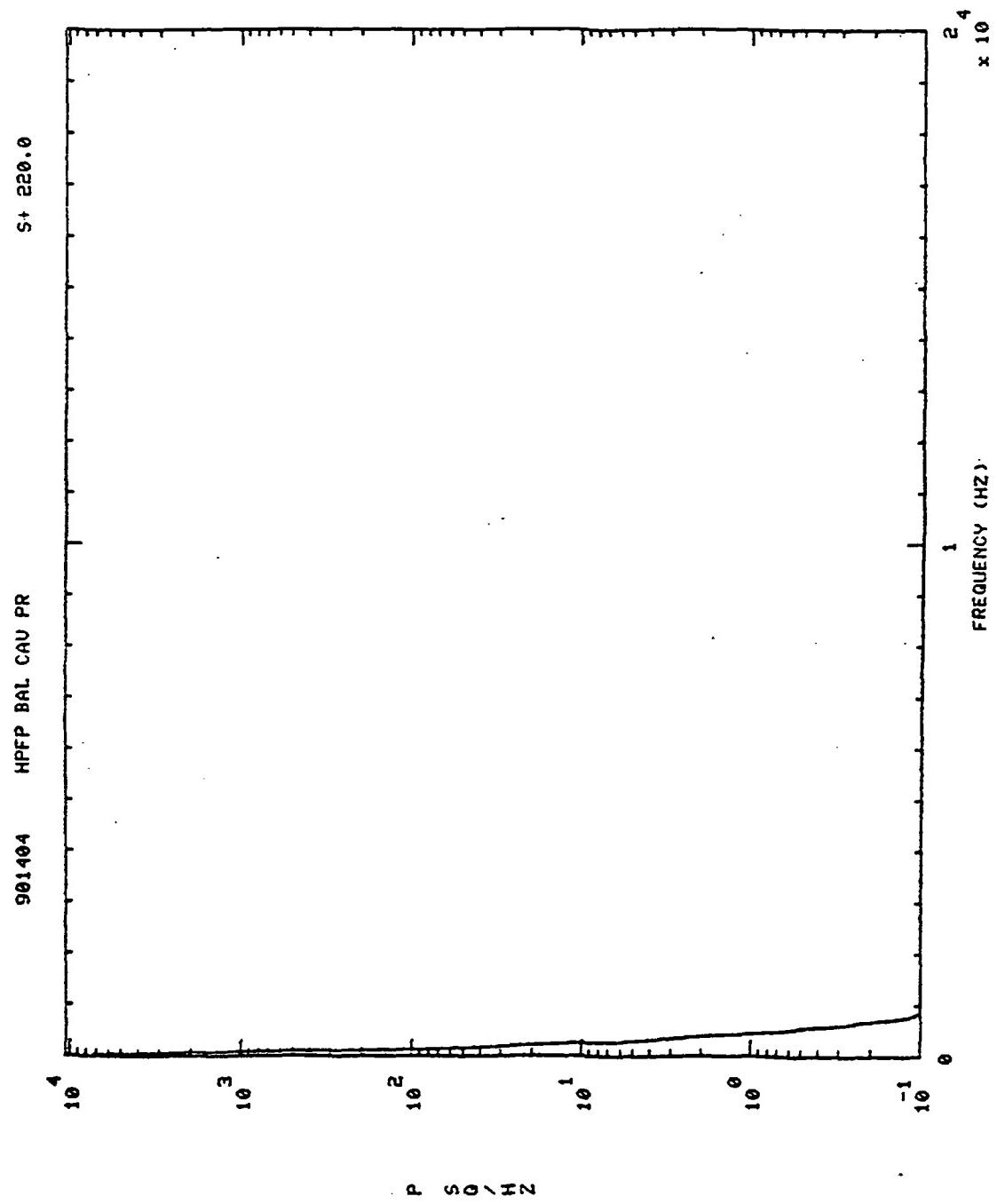




901404 HFPP BAL CAV PR

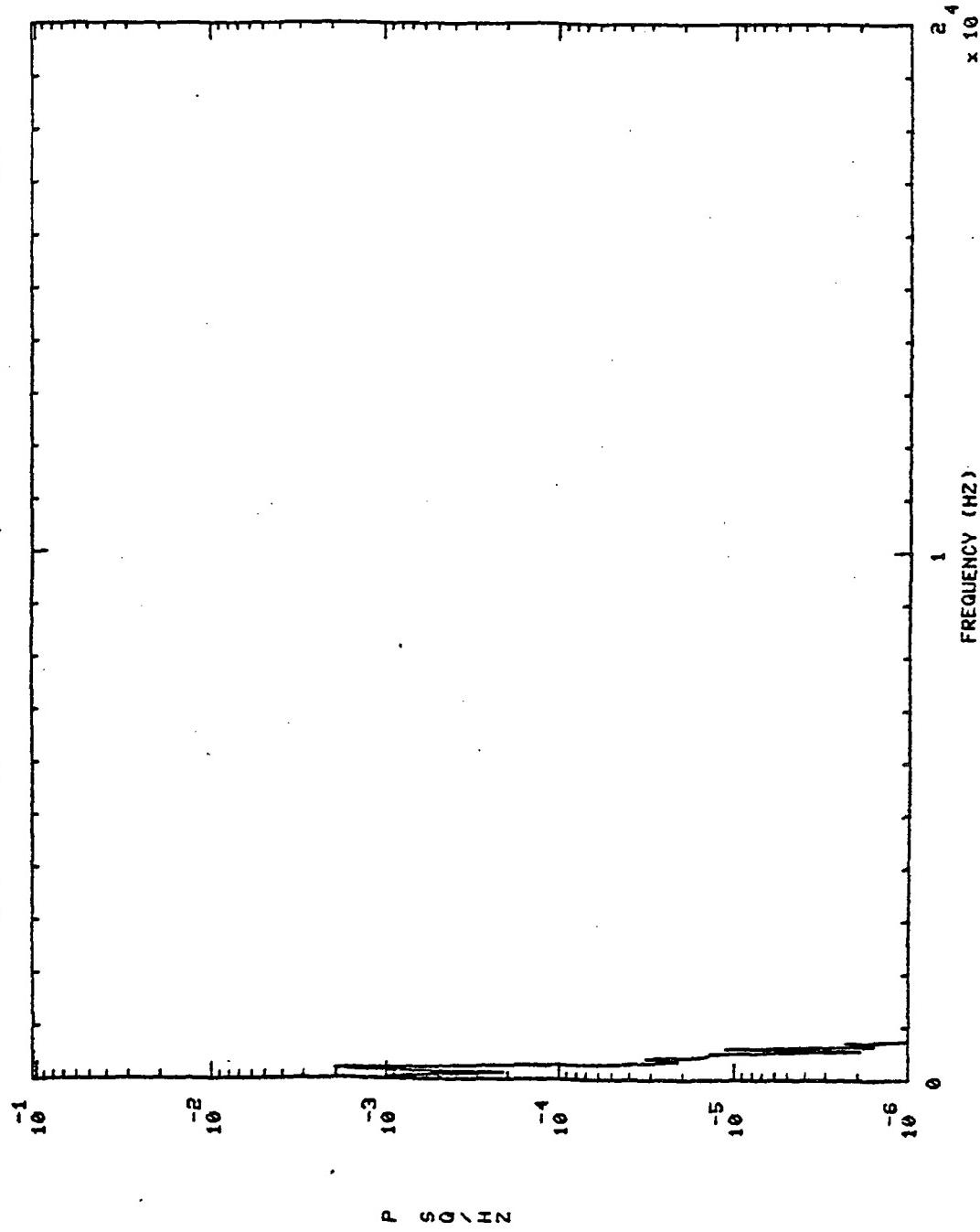
5+ 100.0

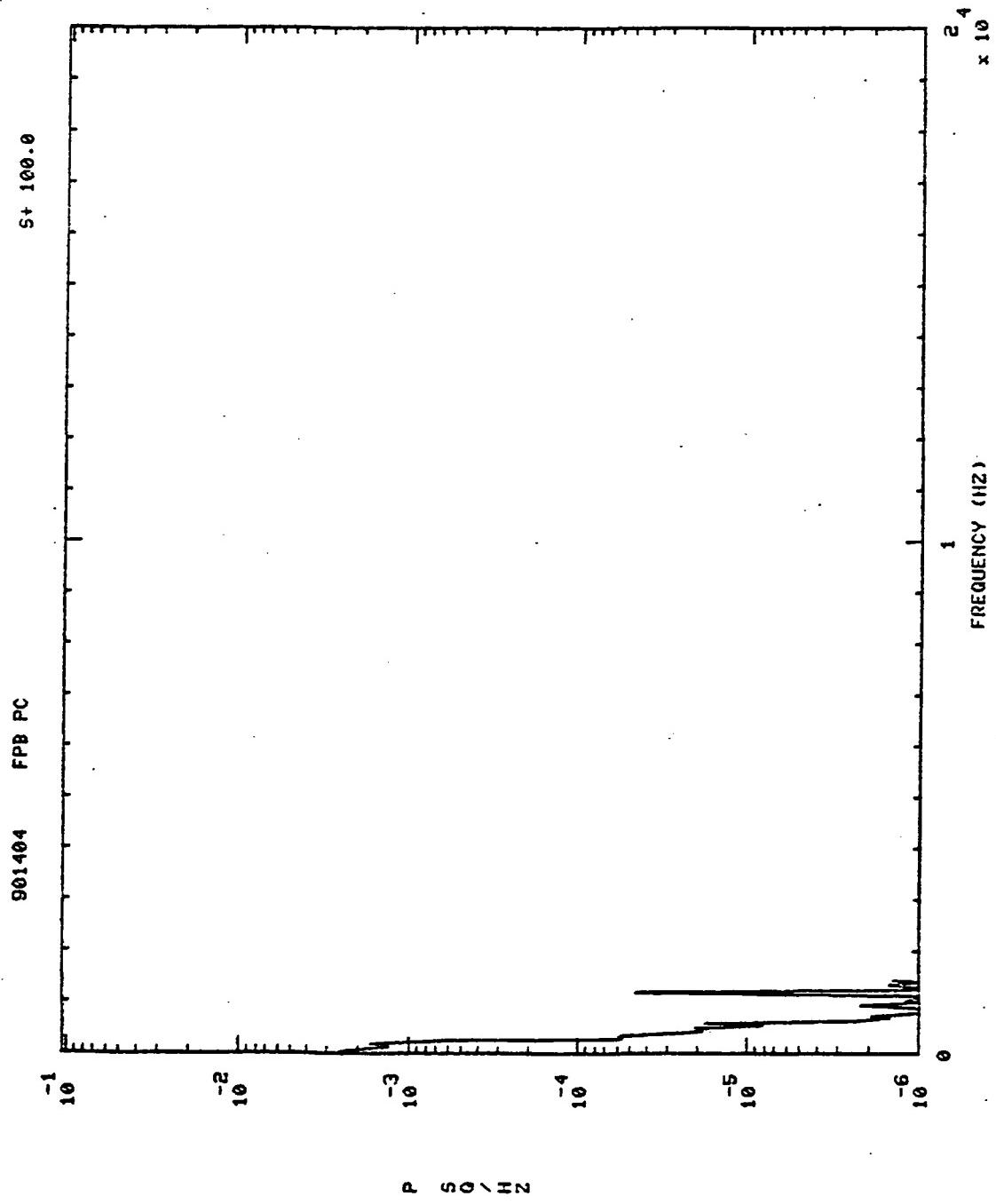




$S + 20.0$

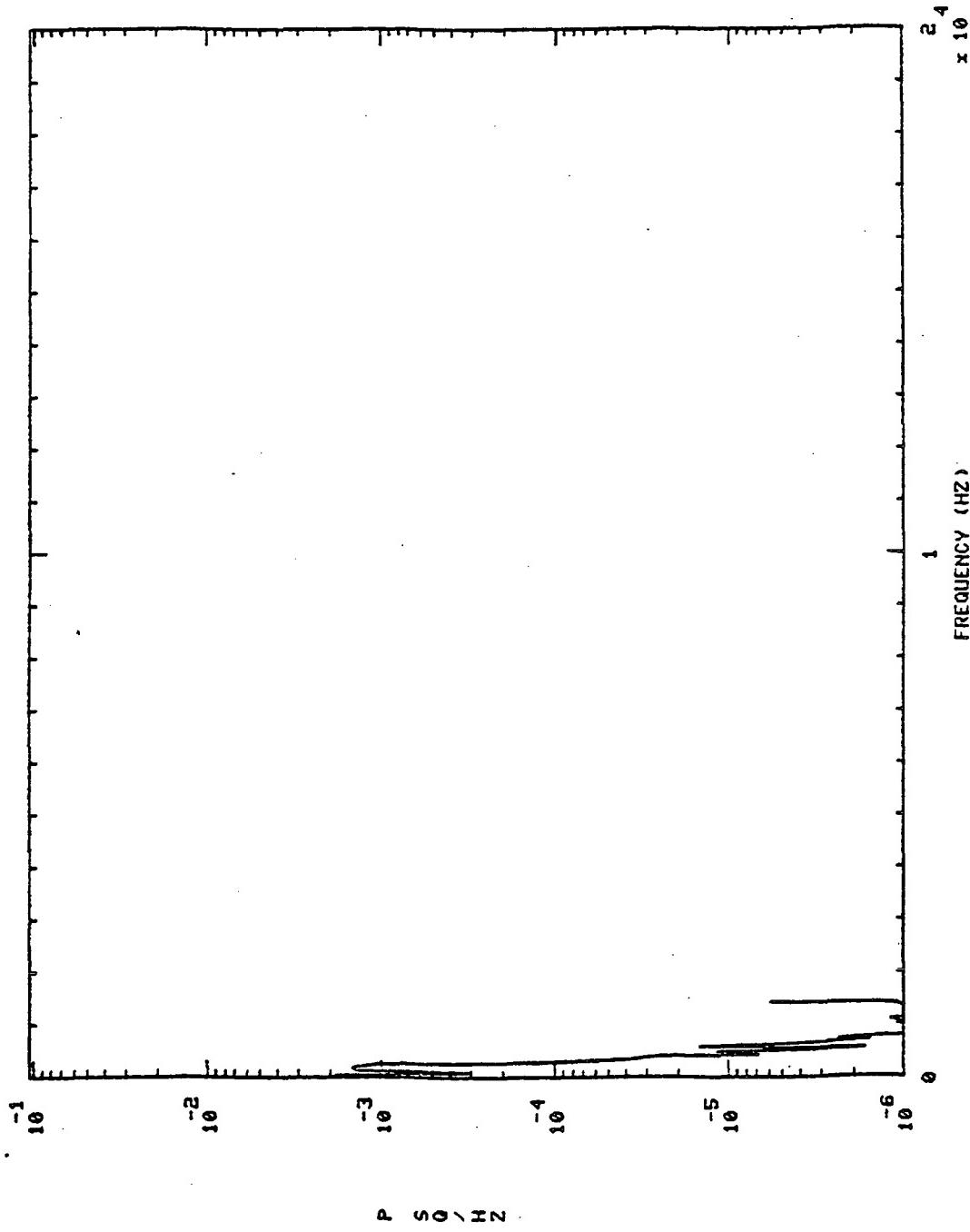
901404 FPB PC

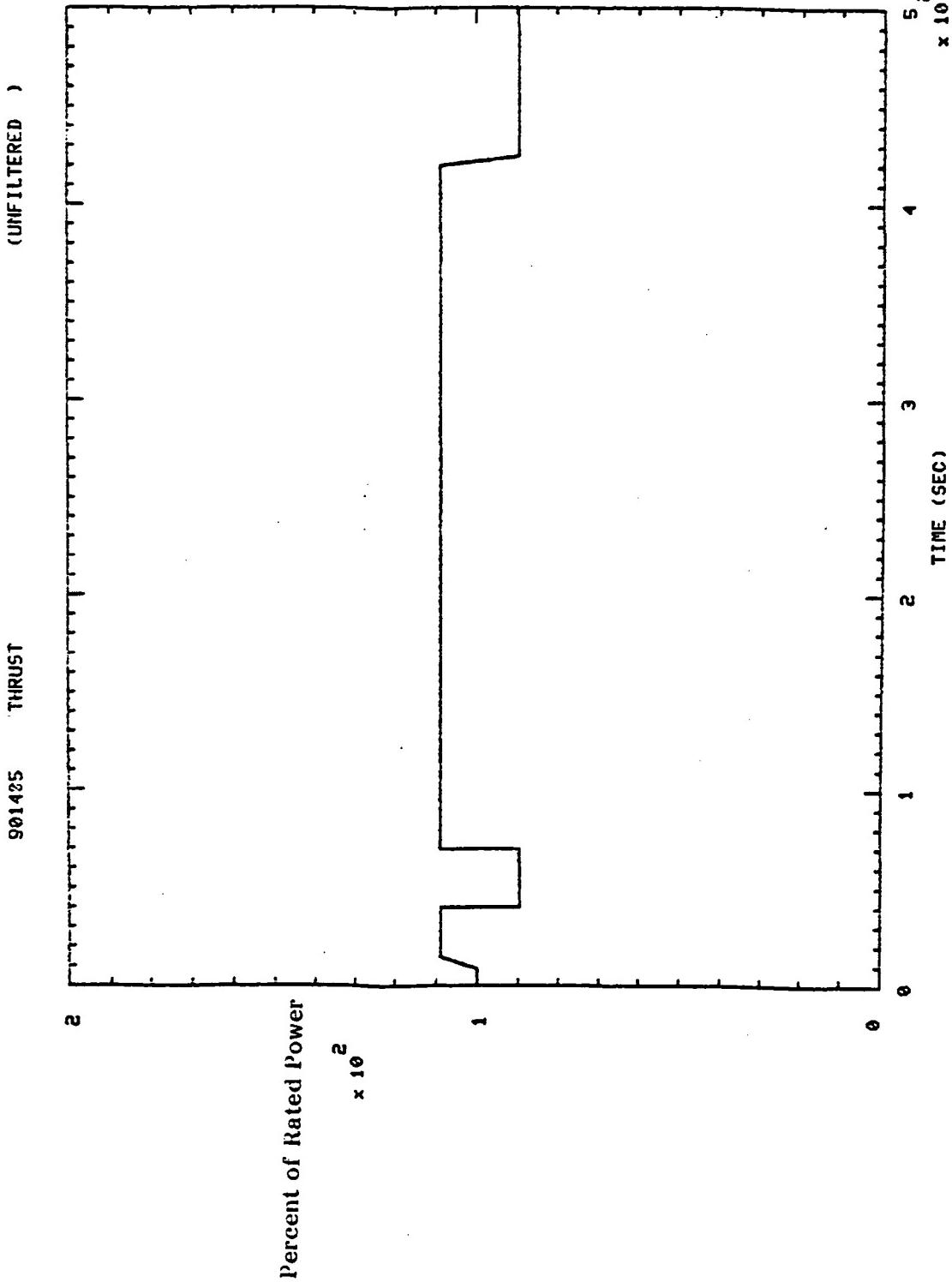


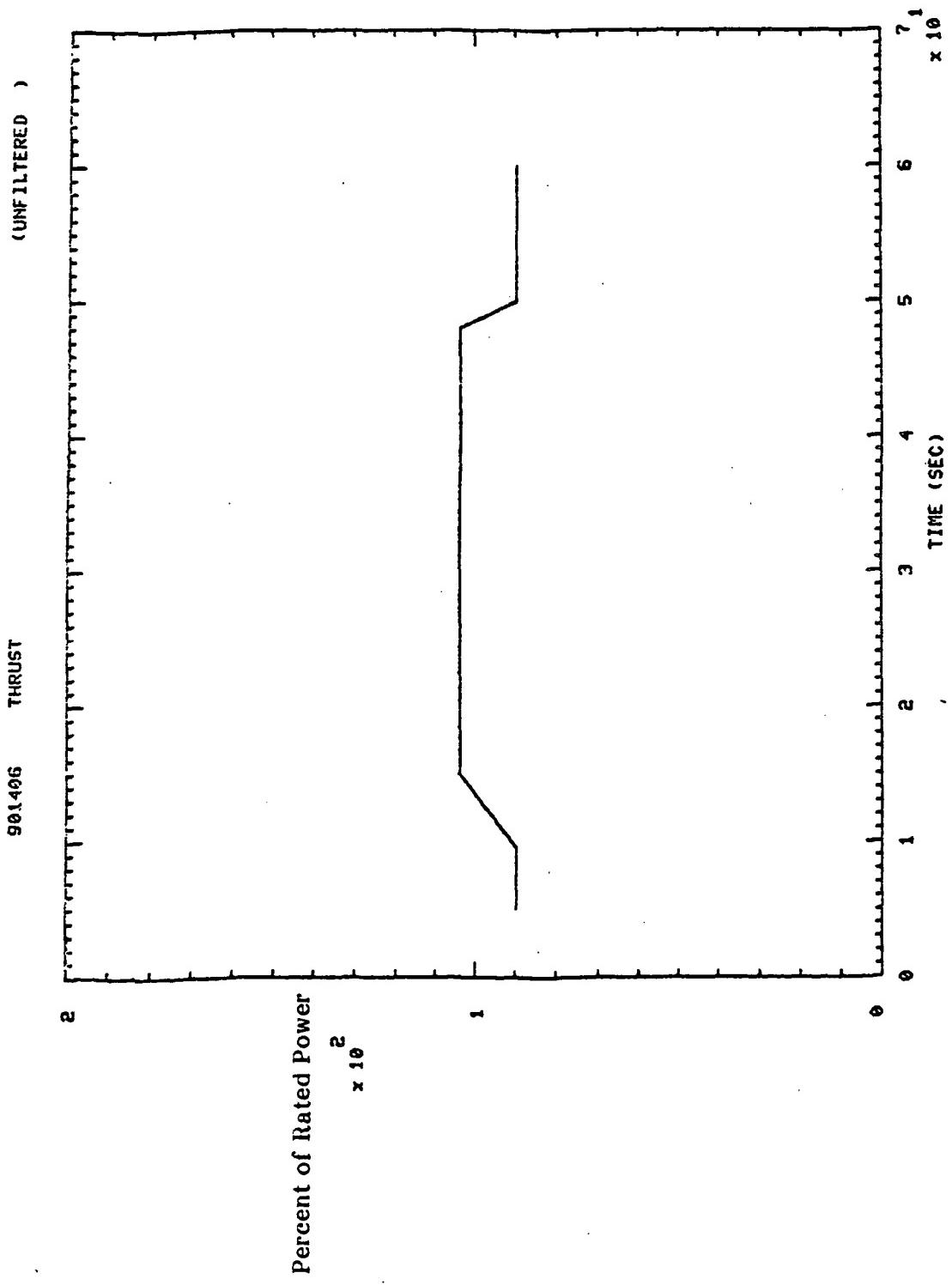


S+ 220.0

901404 FFB PC

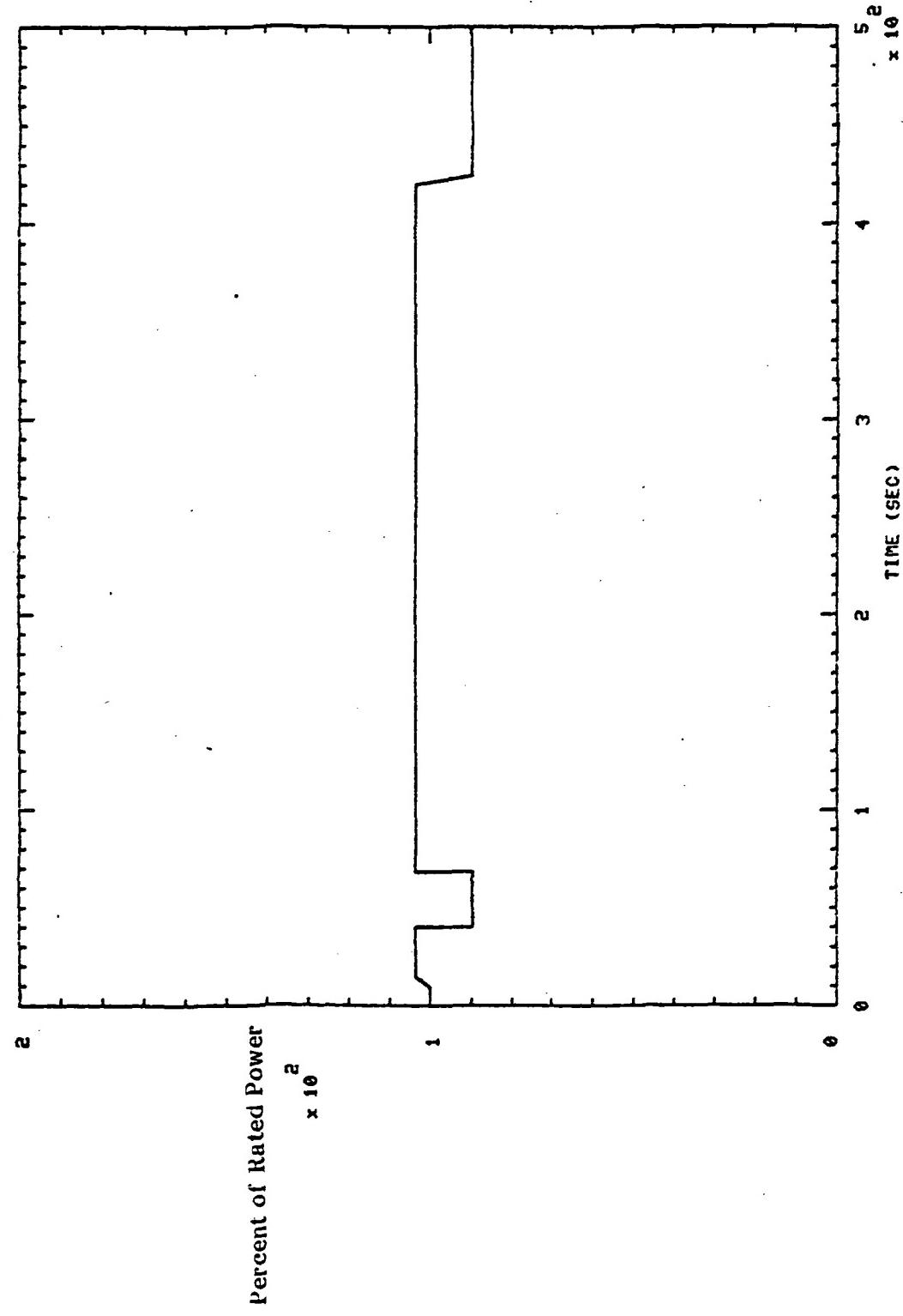






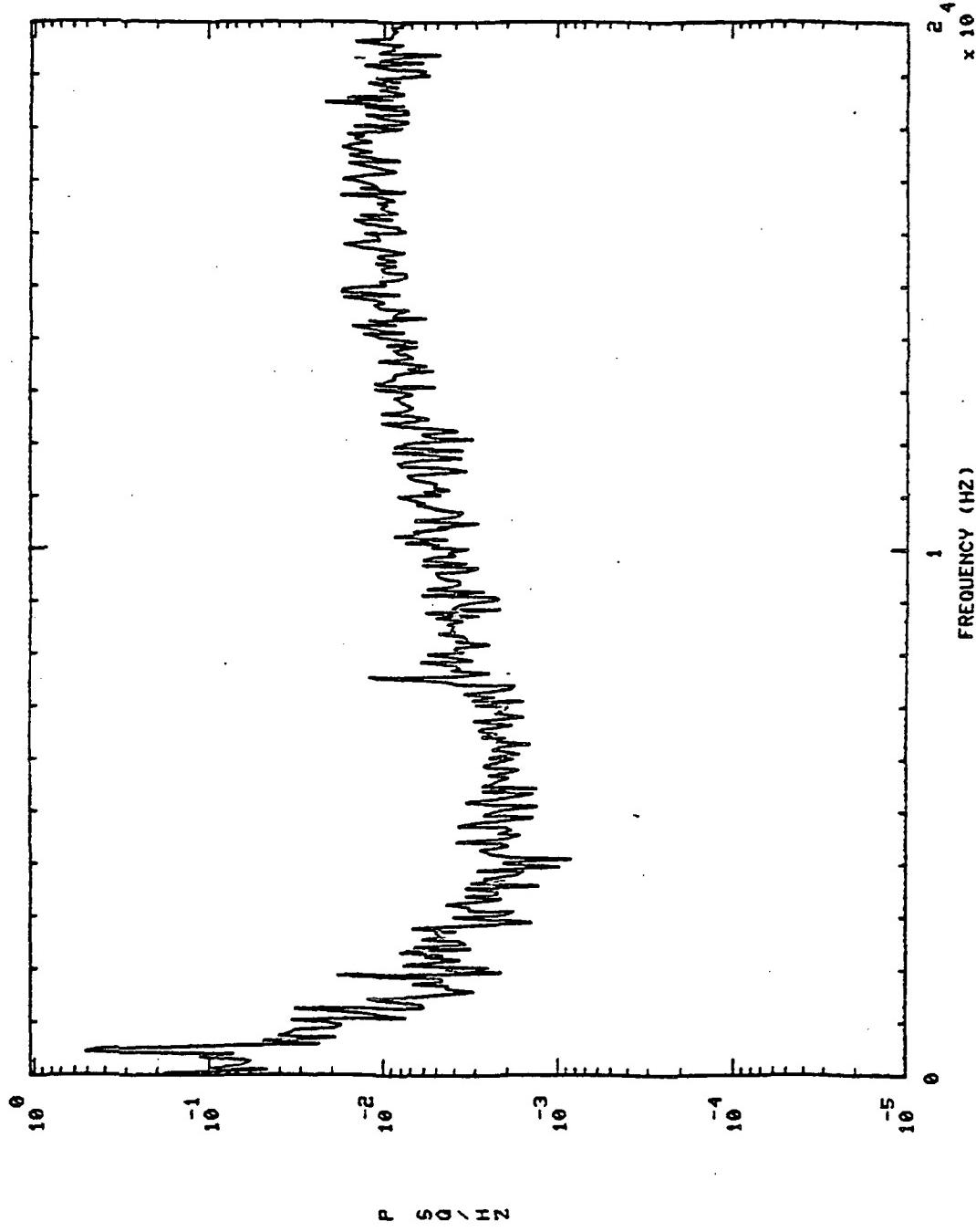
961407 THRUST

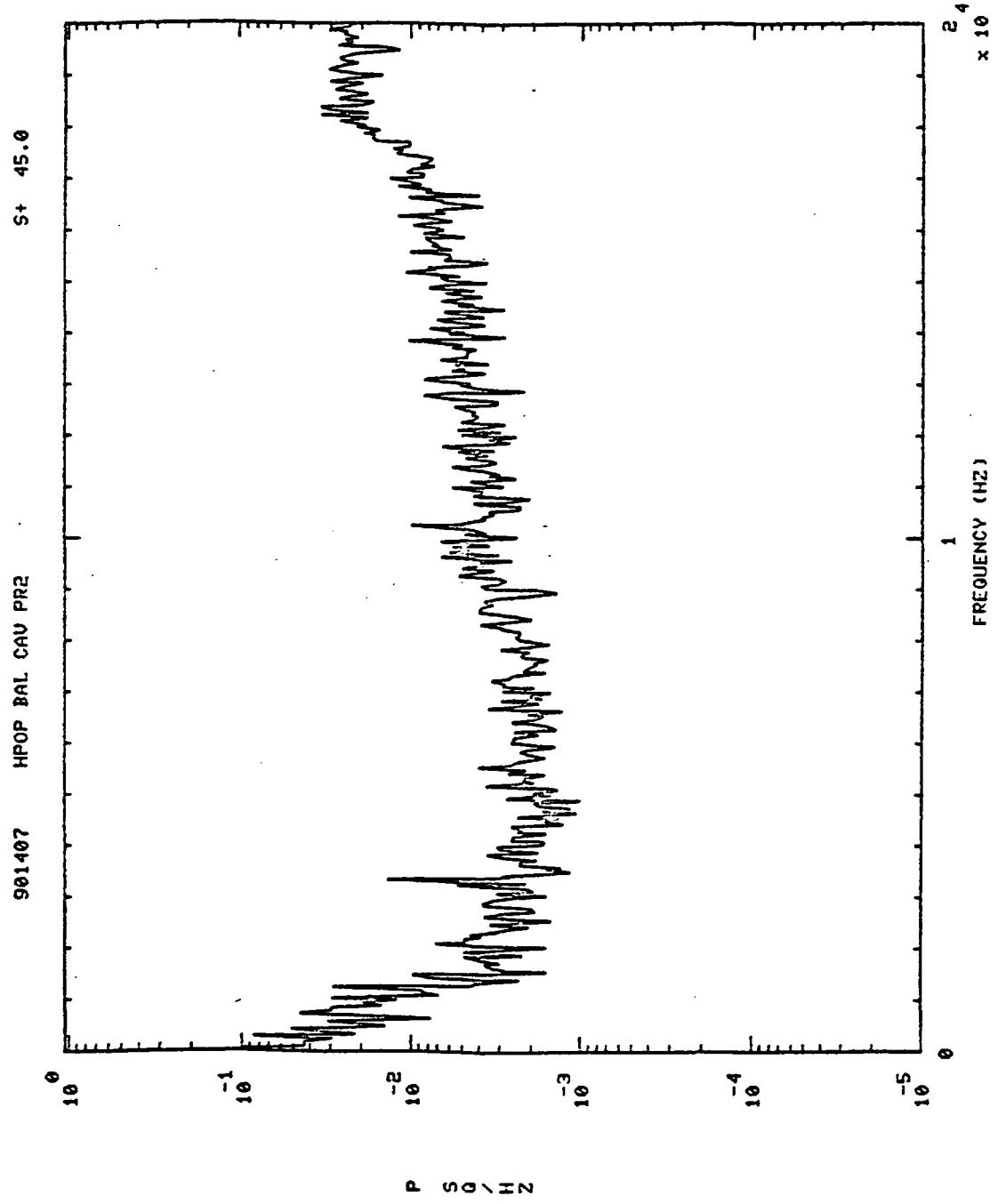
(UNFILTERED)



S+ 20.0

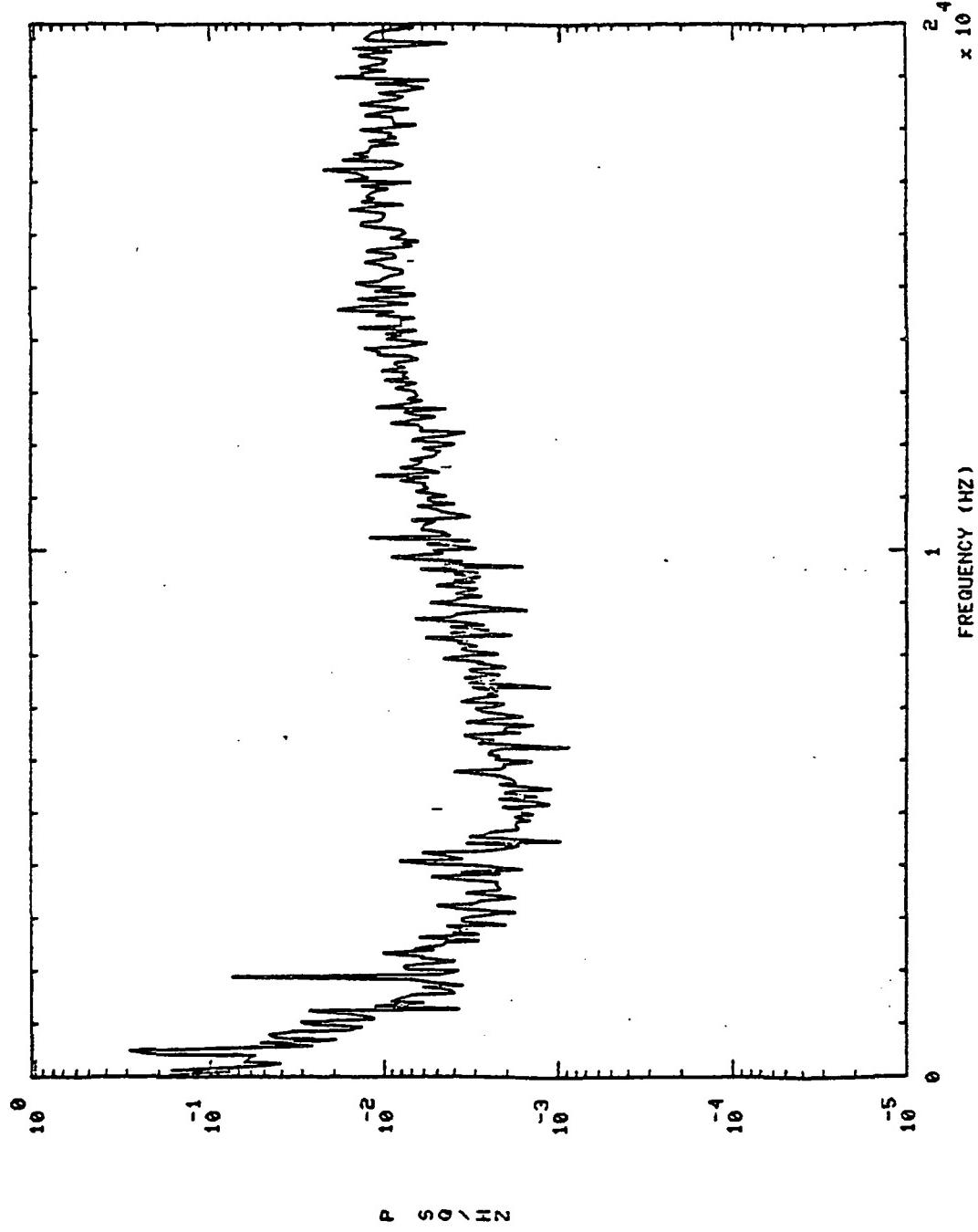
901407 HPOP BAL CAV PR2

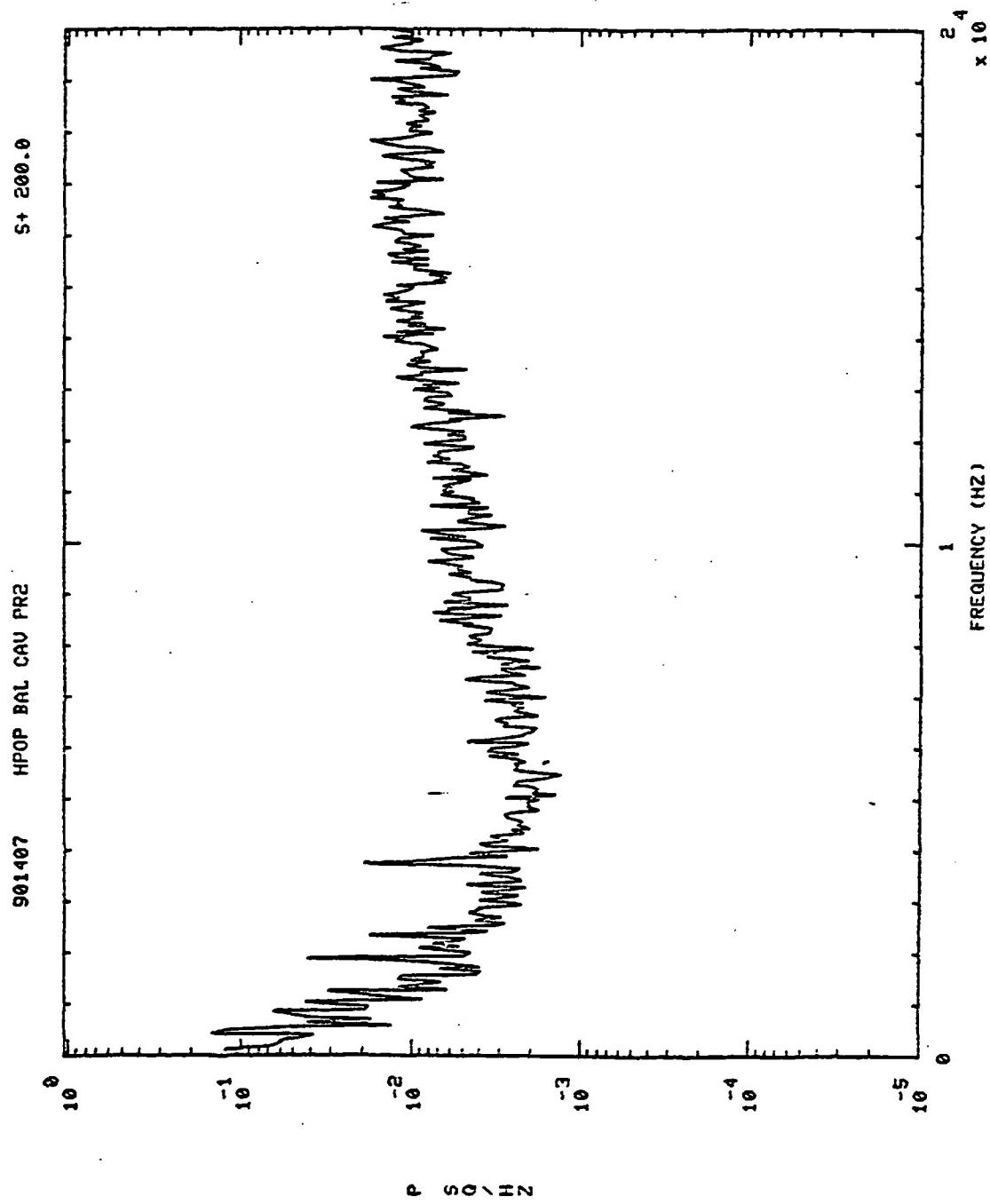




901407 HPOP BAL CAV PR2

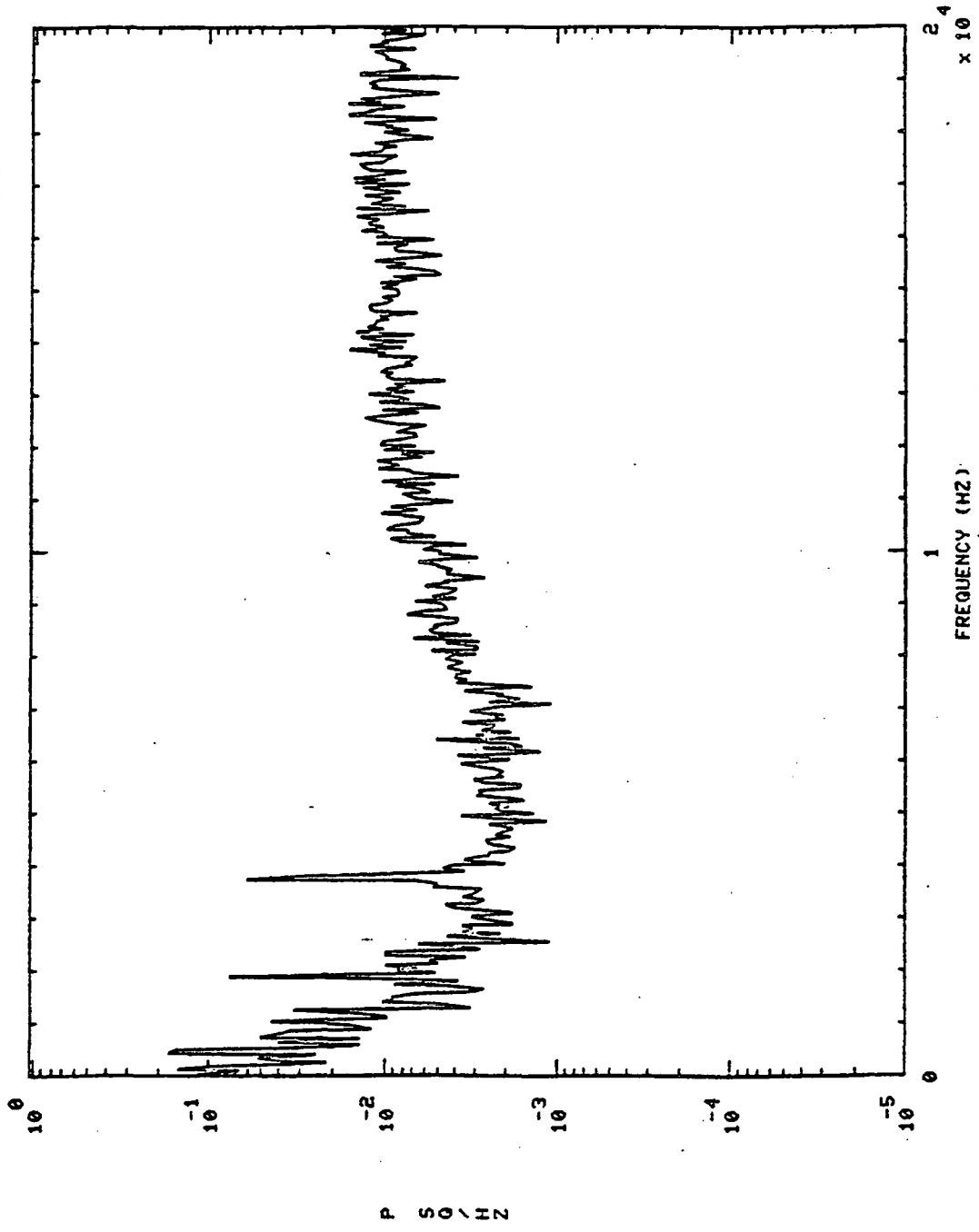
S+ 75.0

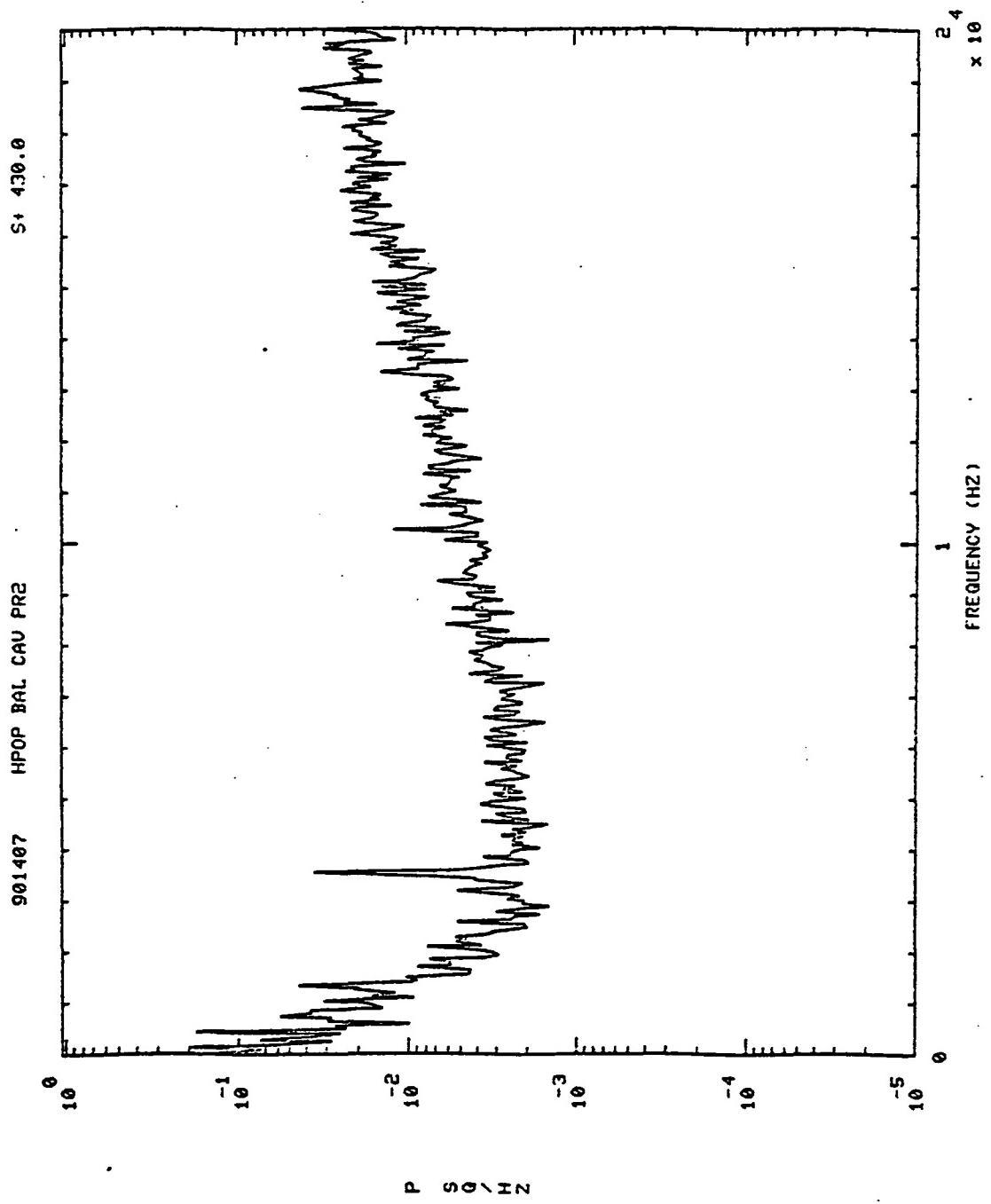




901407 HFOP BAL CAU PR2

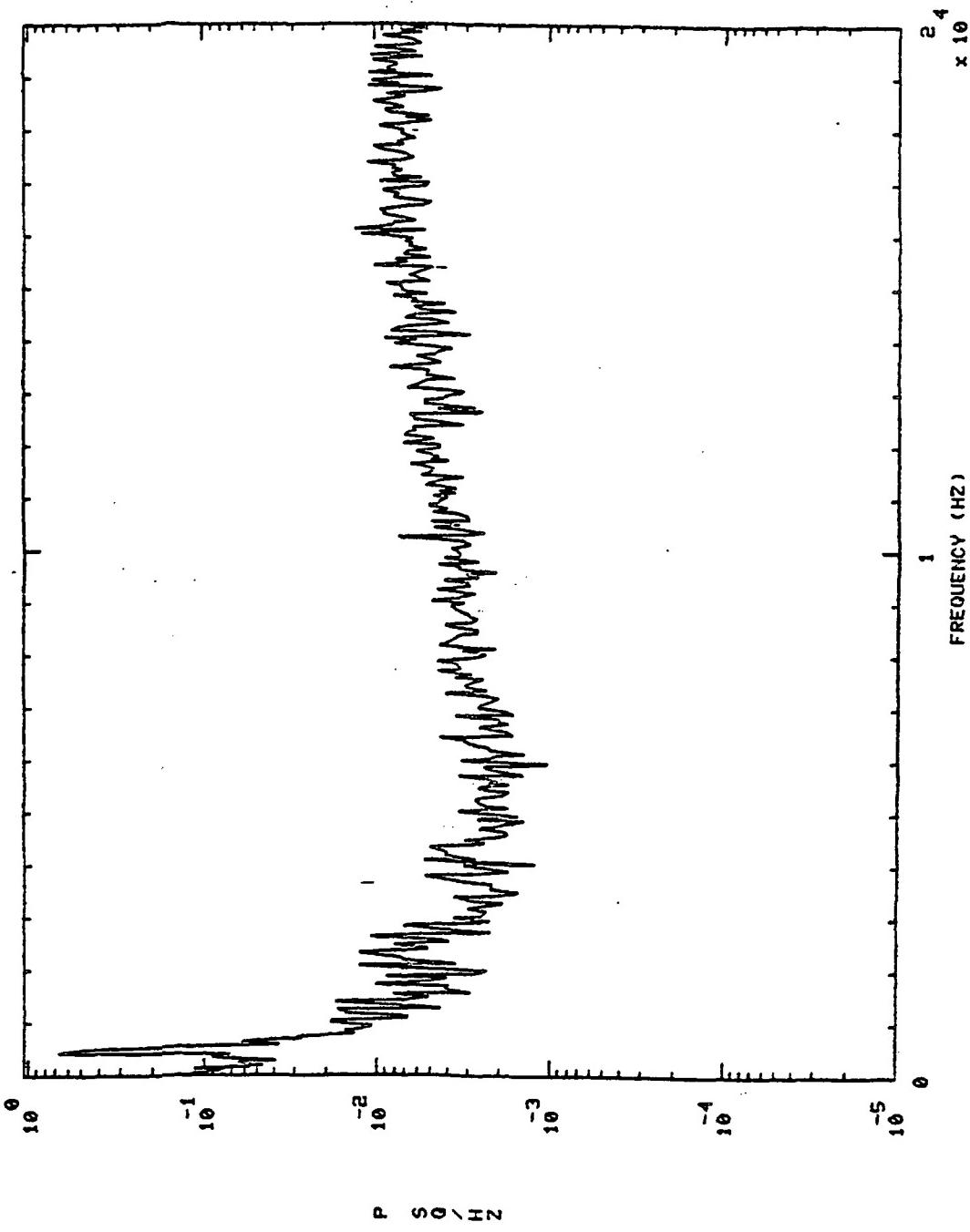
S+ 400.0

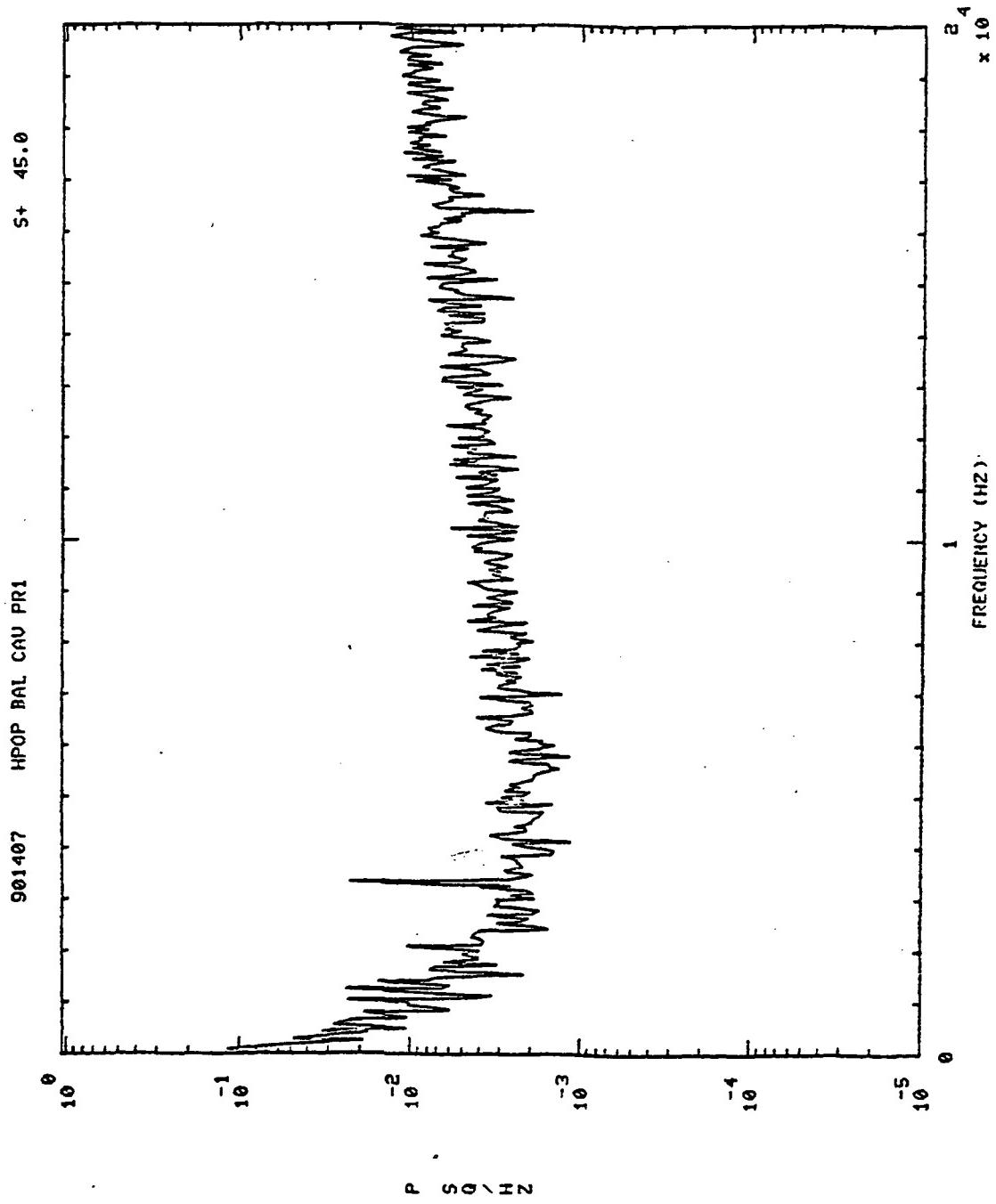




901407 HP0P BAL CAV PR1

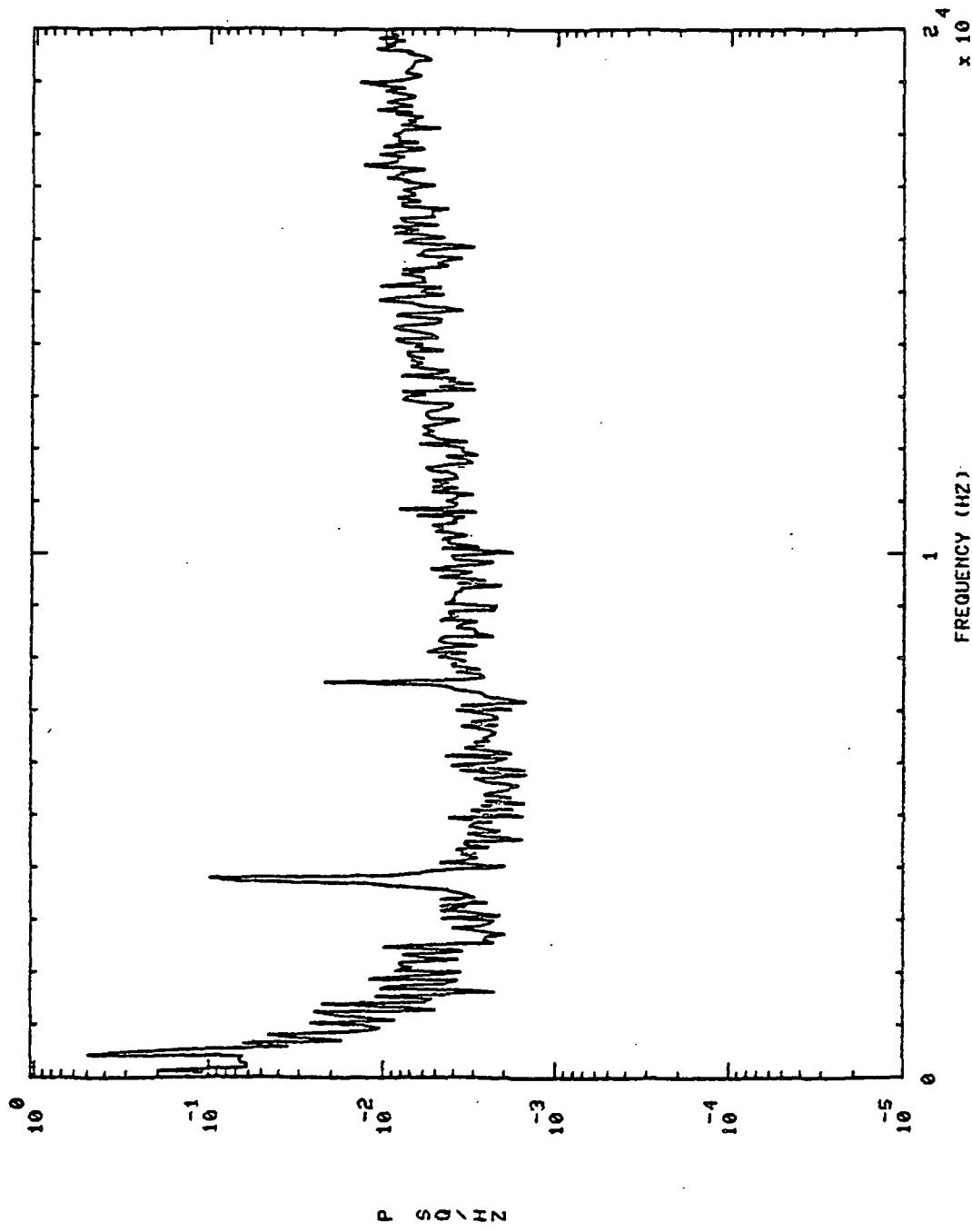
S+ 20.0





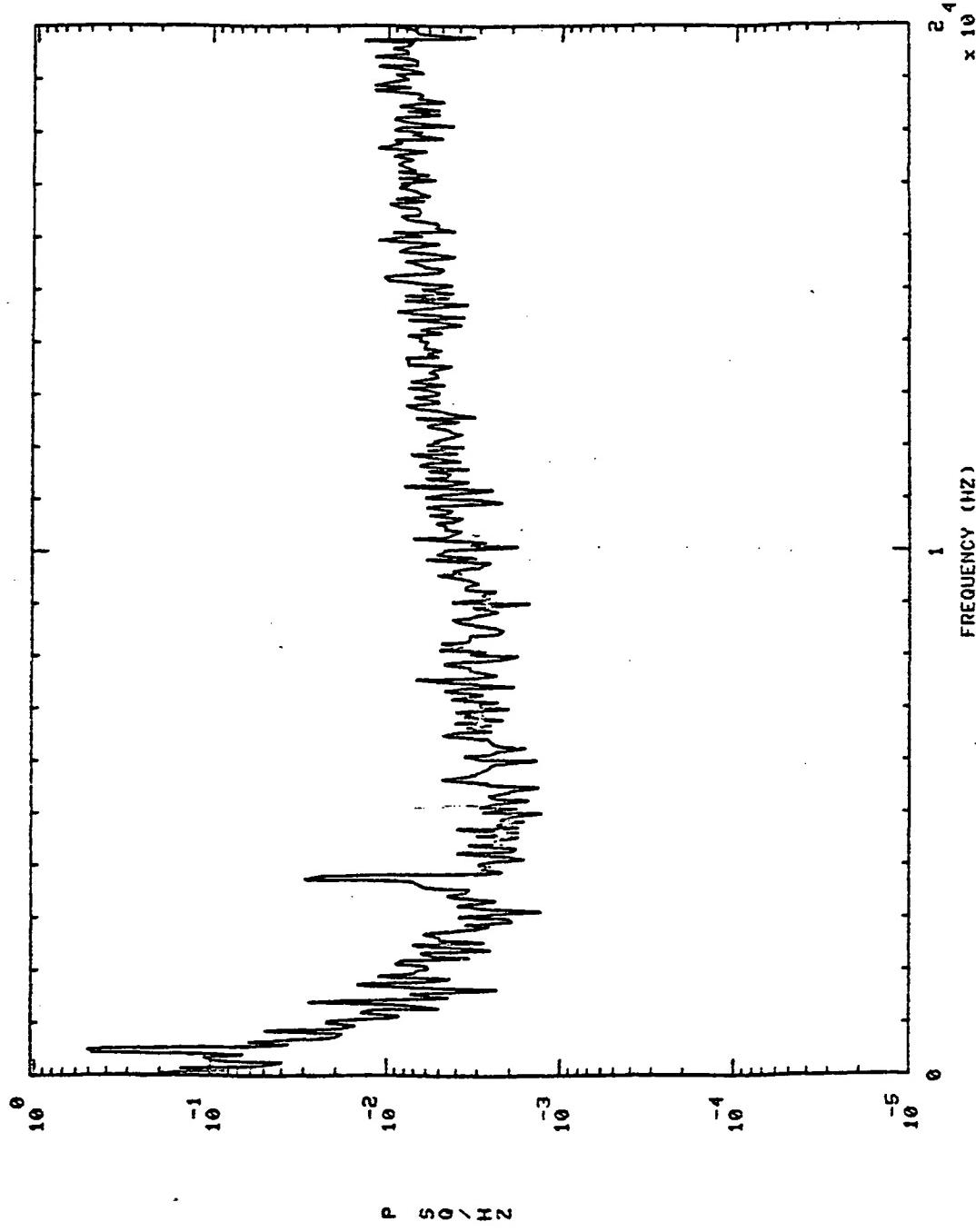
901407 HPOP DAL CAV PR1

S+ 75.0



901407 HPOP BAL CAU PR1

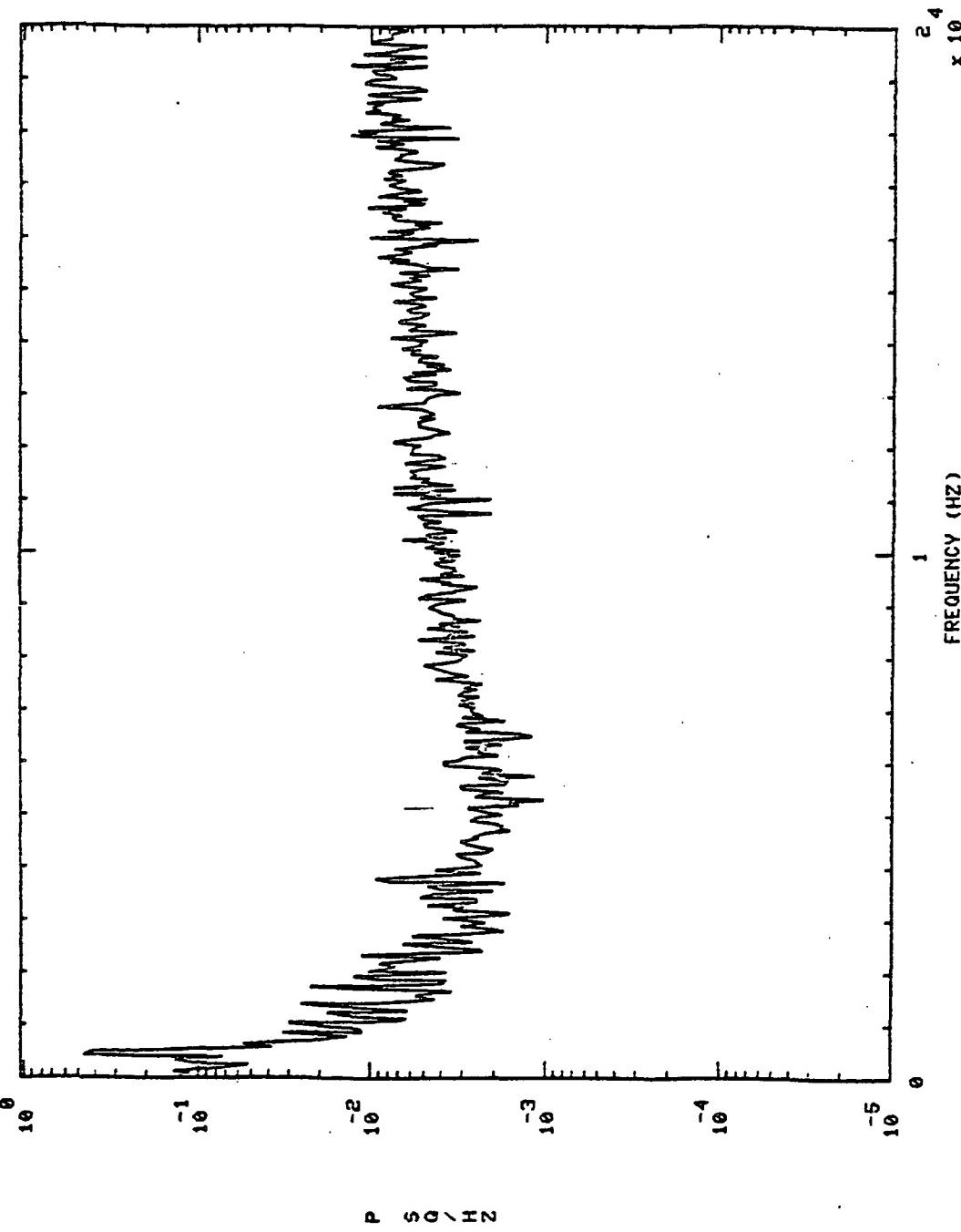
S+ 200.0

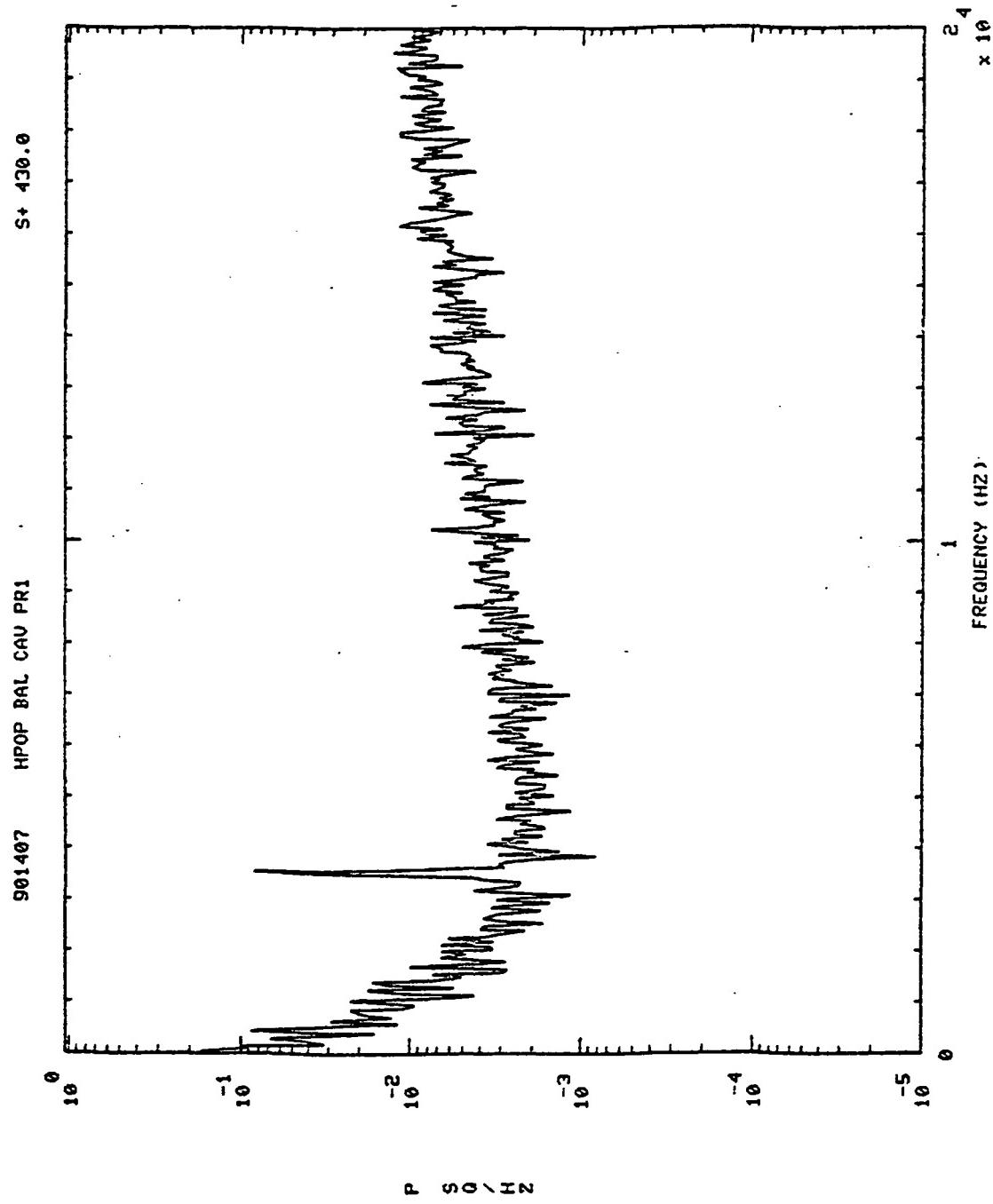


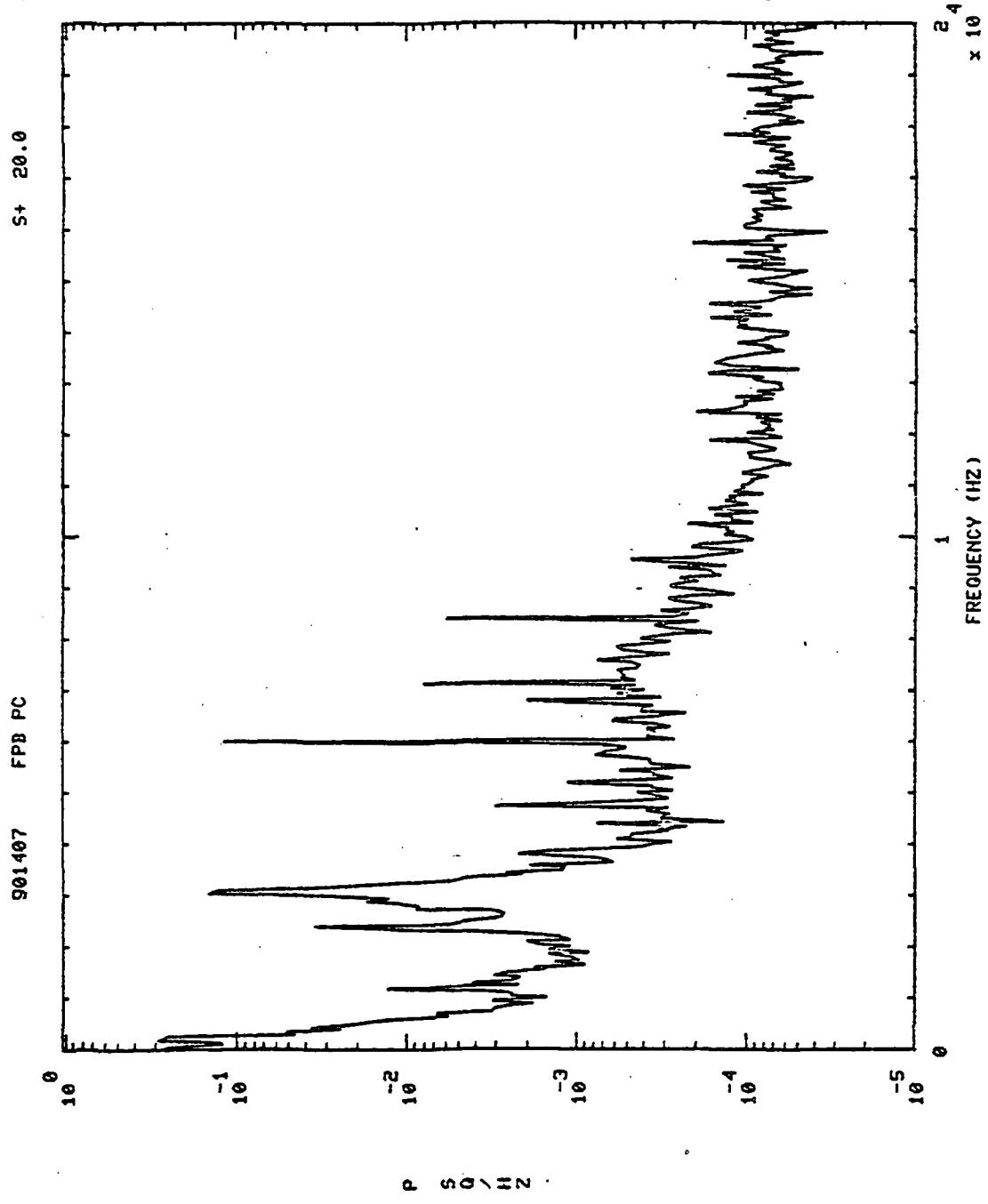
P S G / HZ

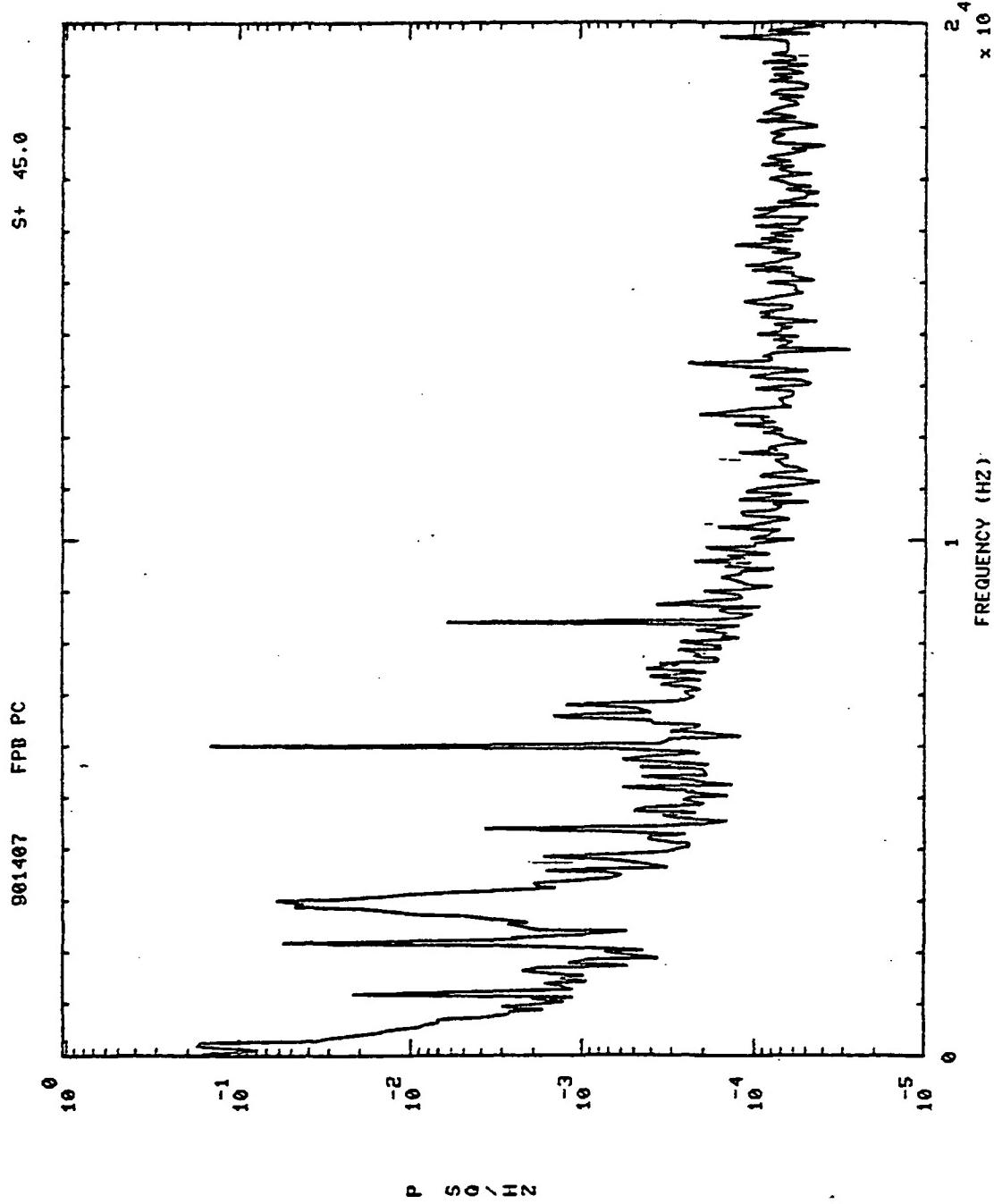
901407 HPOP BAL CAU PR1

S+ 400.0



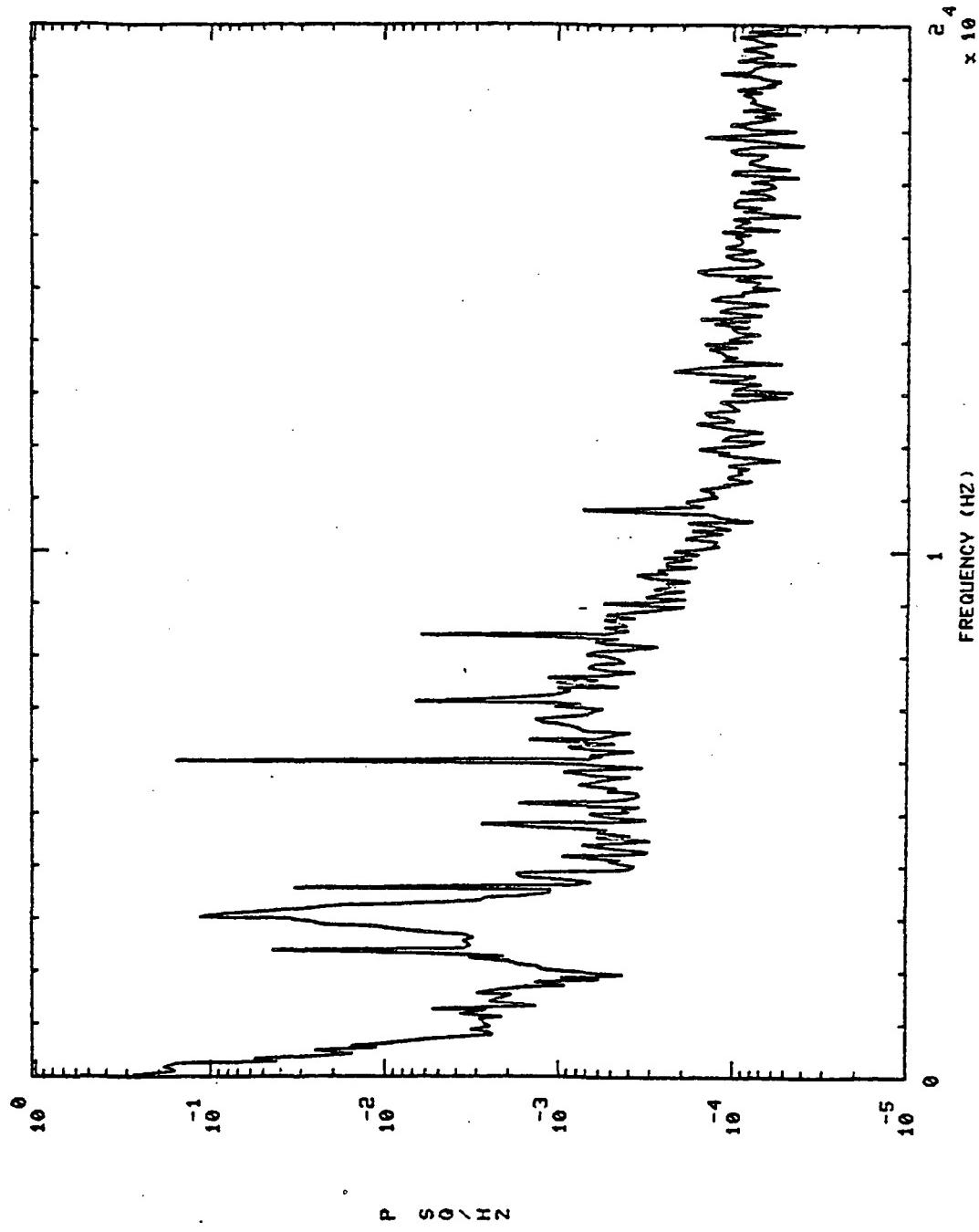




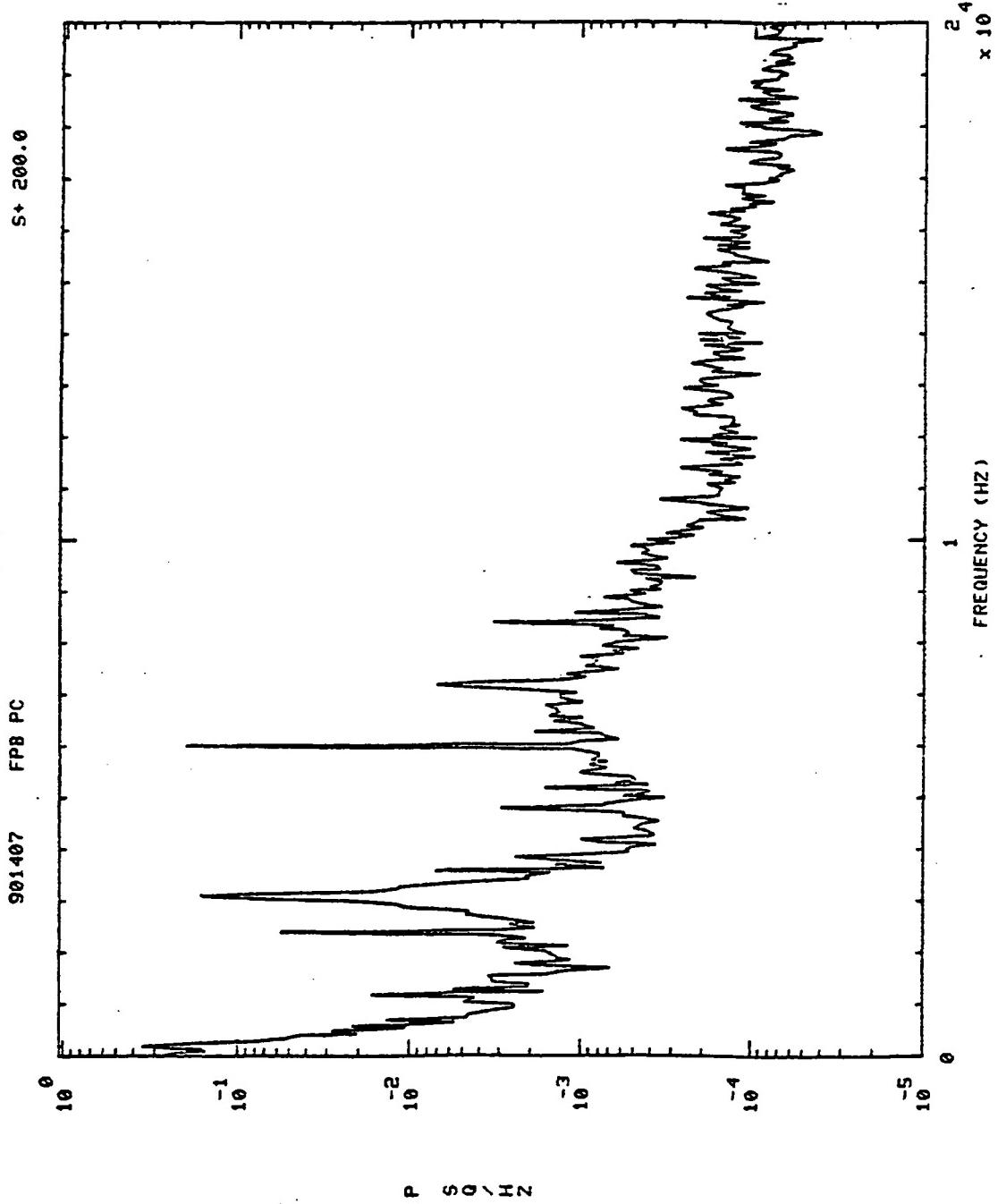


901407 FPB PC

S + 75.0

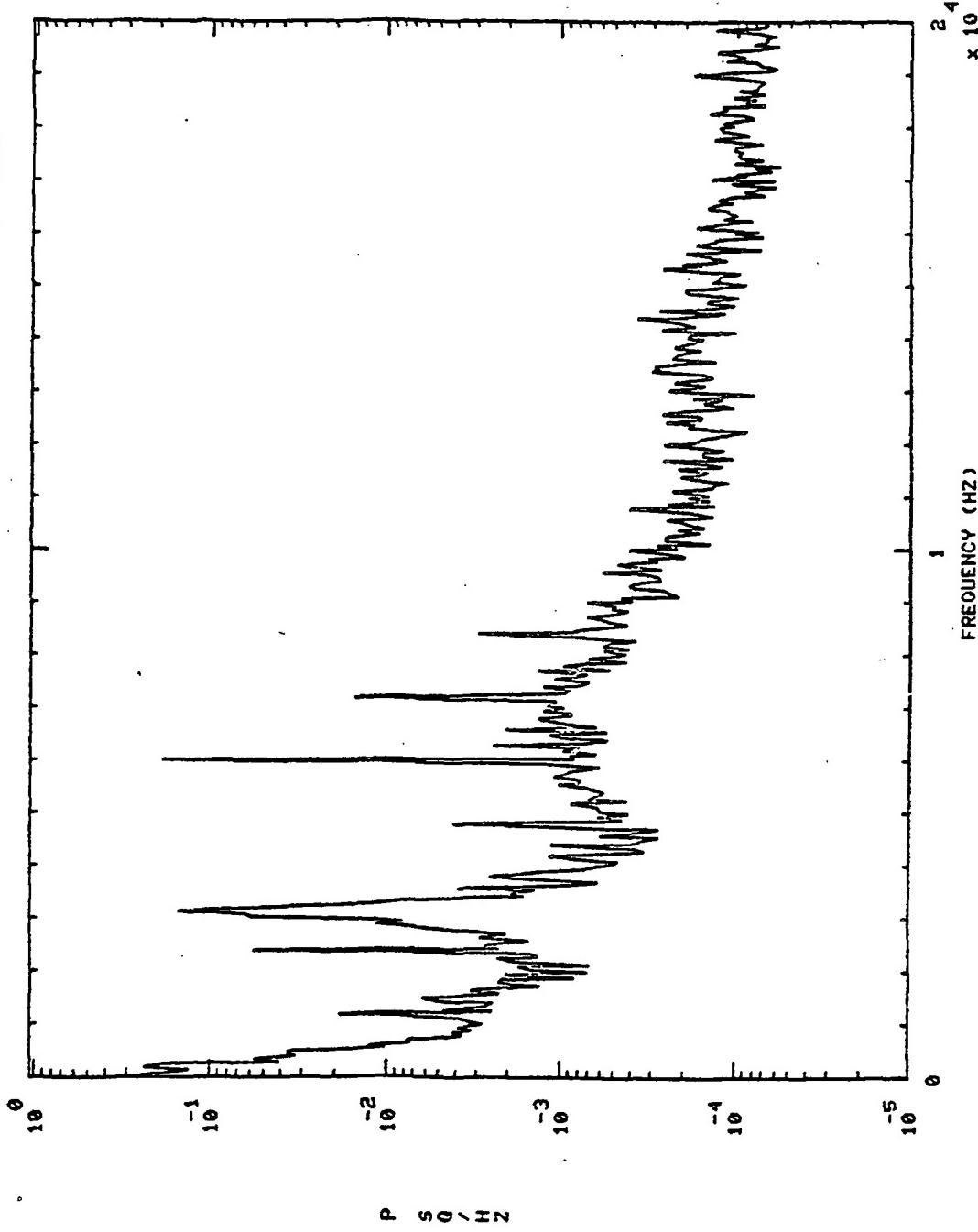


PSD / HZ



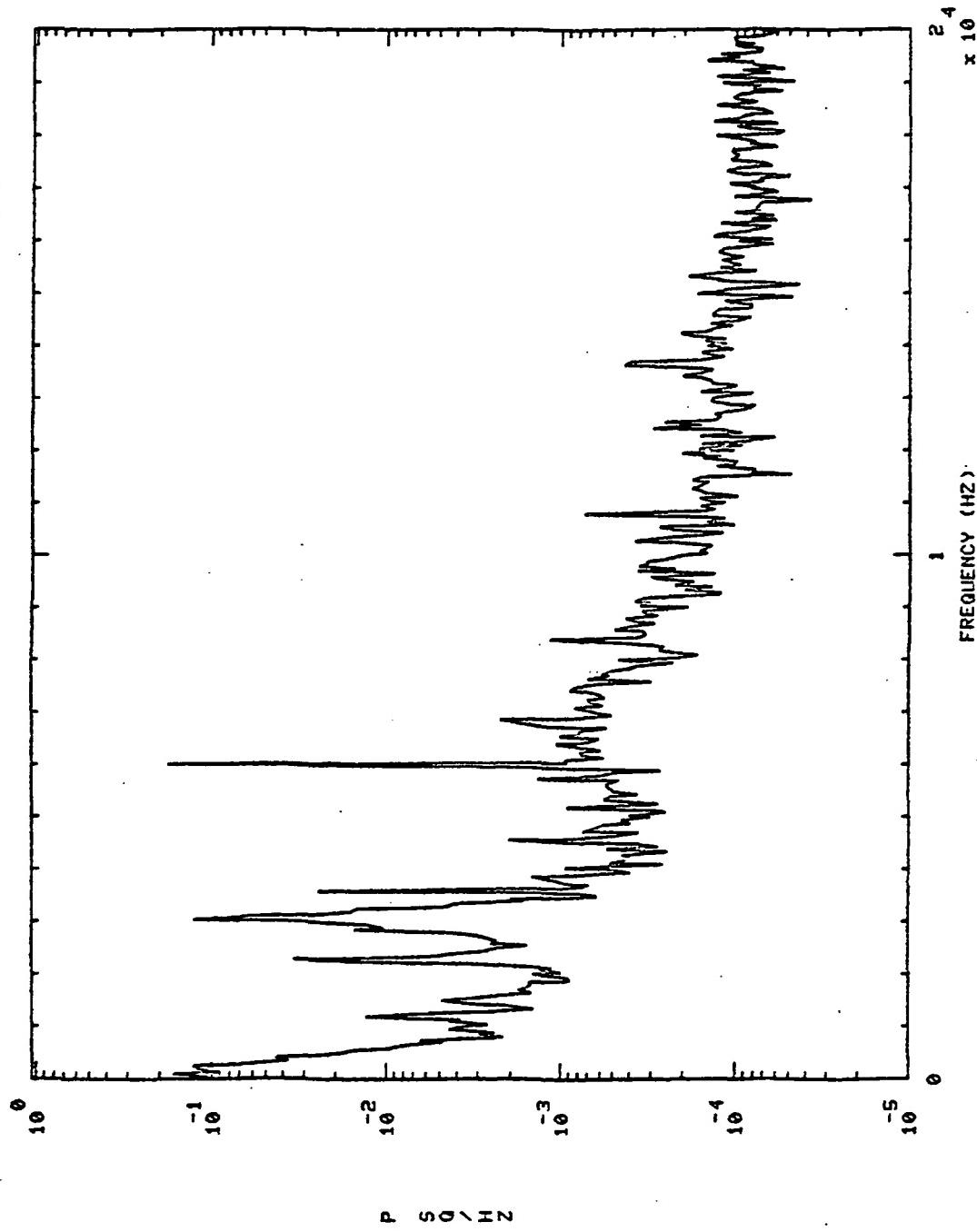
S+ 400.0

901407 FPB FC



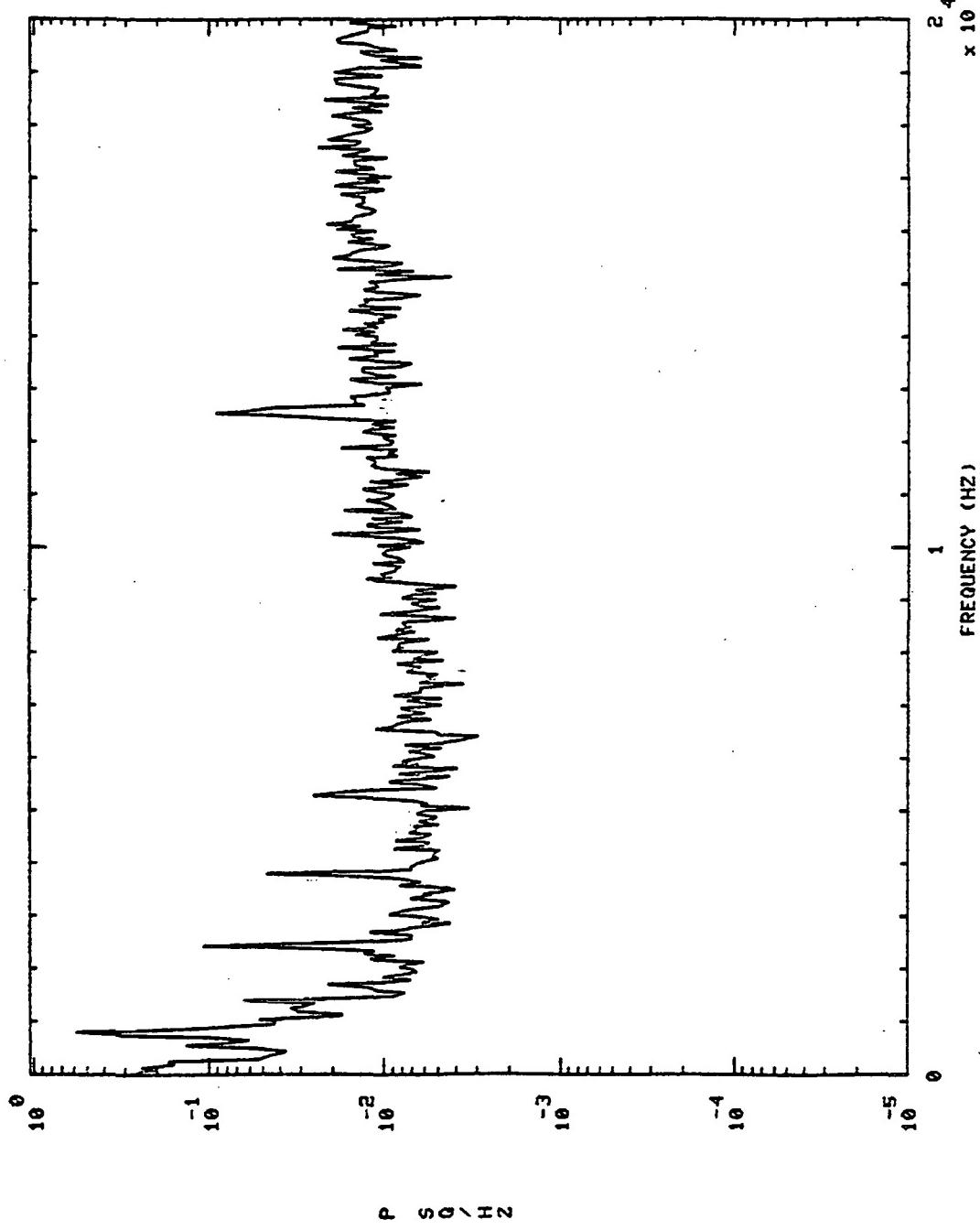
P S Q / Hz

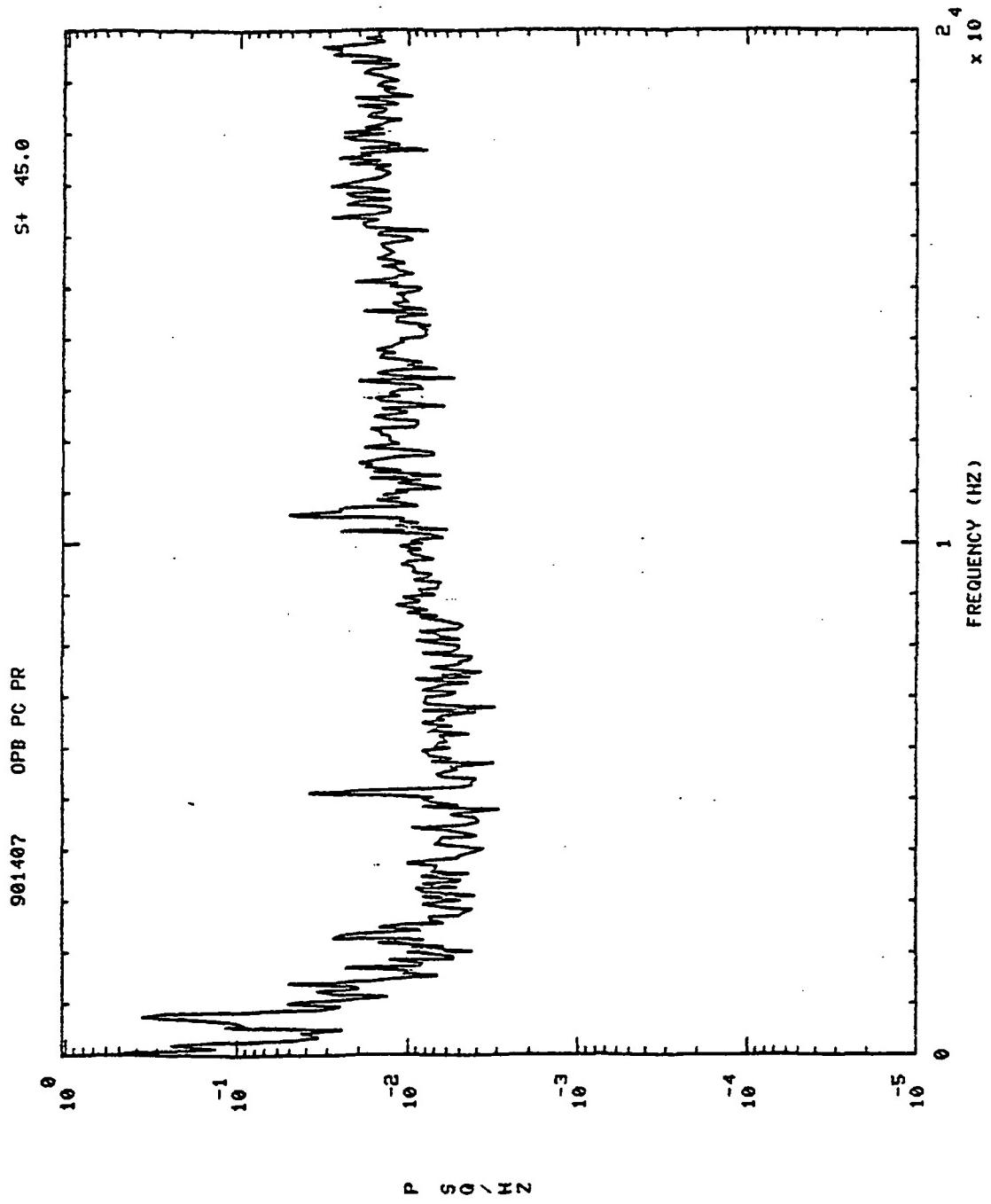
5+ 430.0
901407 FFB PC



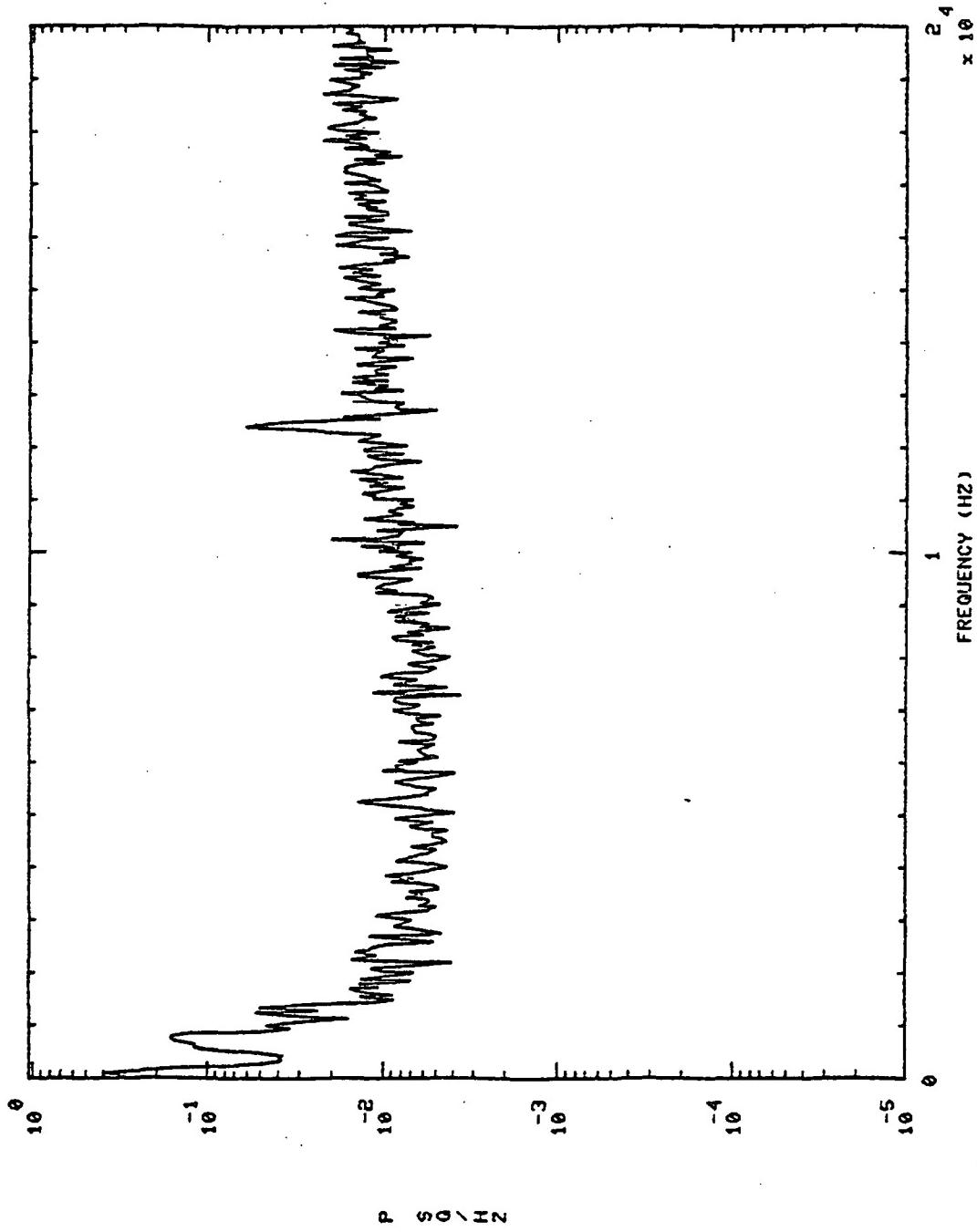
S+ 20.0

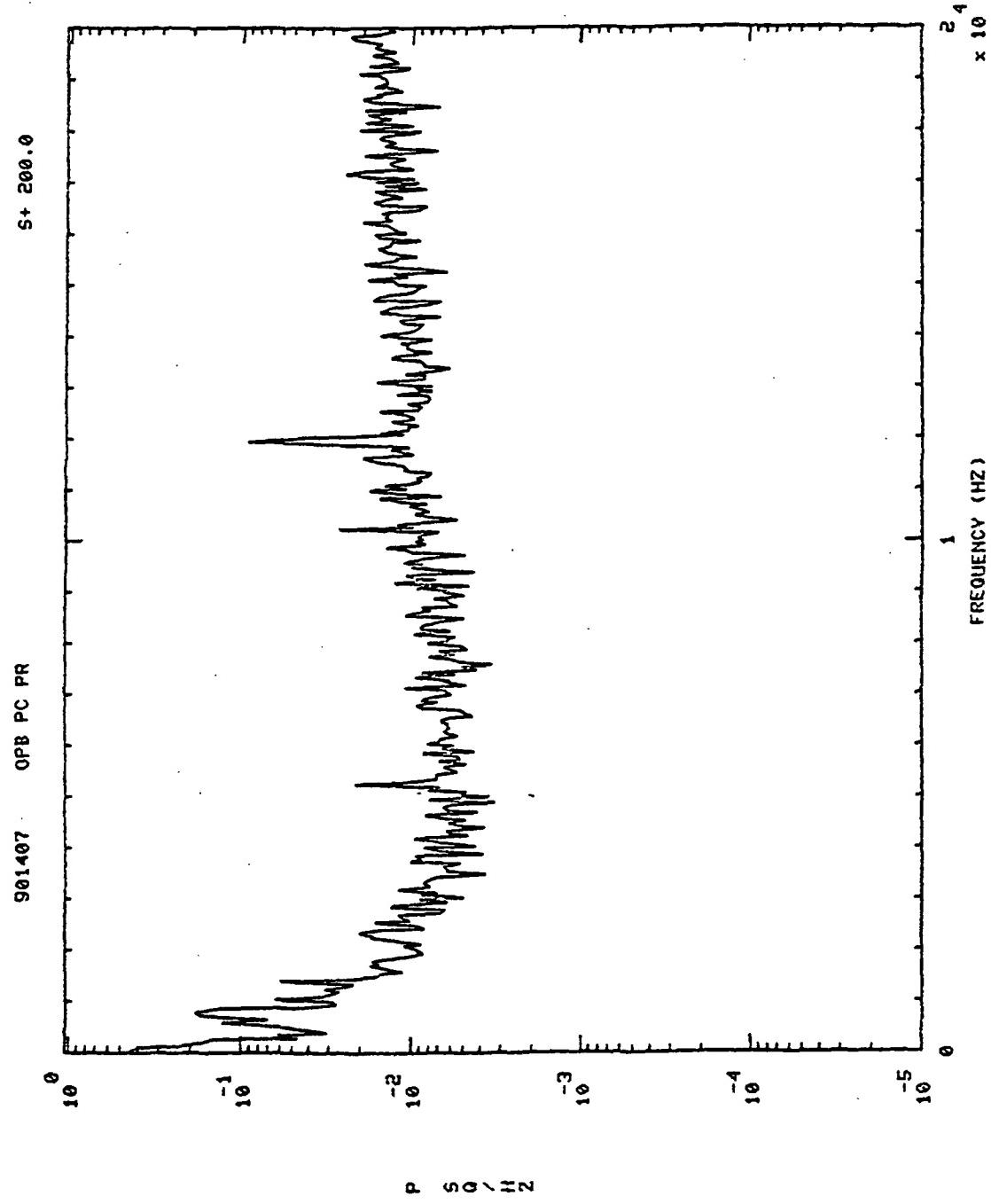
901407 OPB PC PR





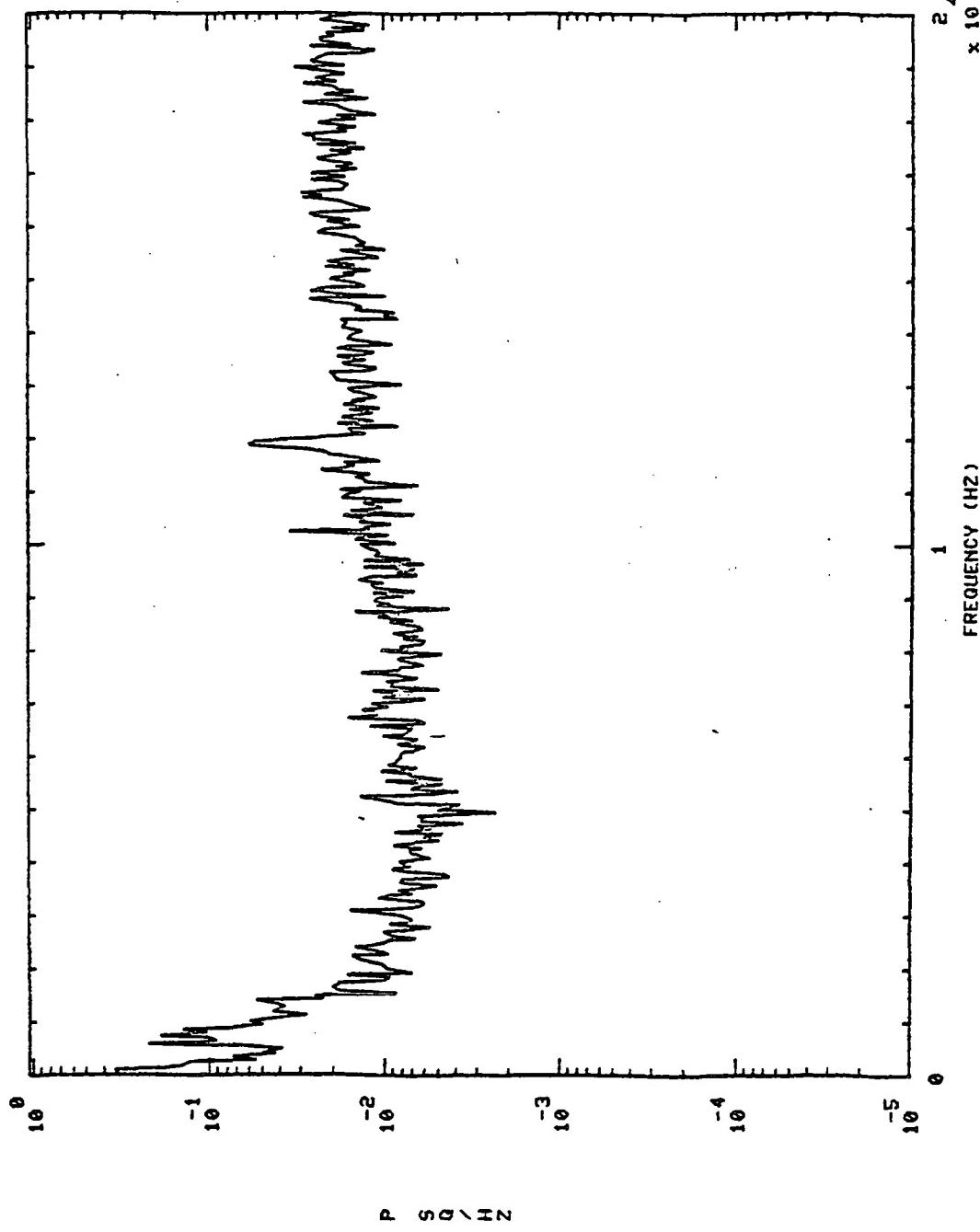
901407 OPB PC PR S+ 75.0



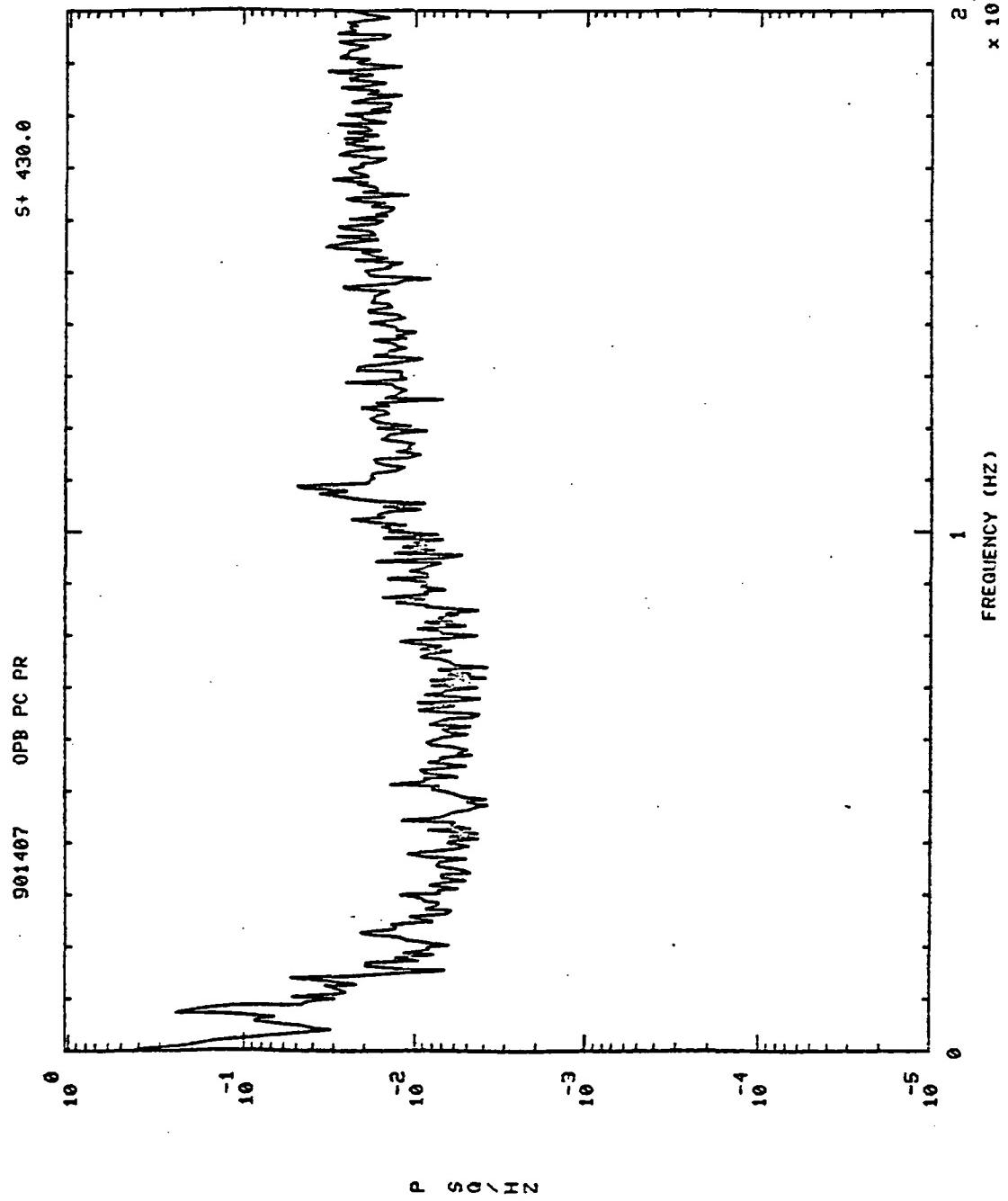


S+ 400.0

901407 OPB PC PR

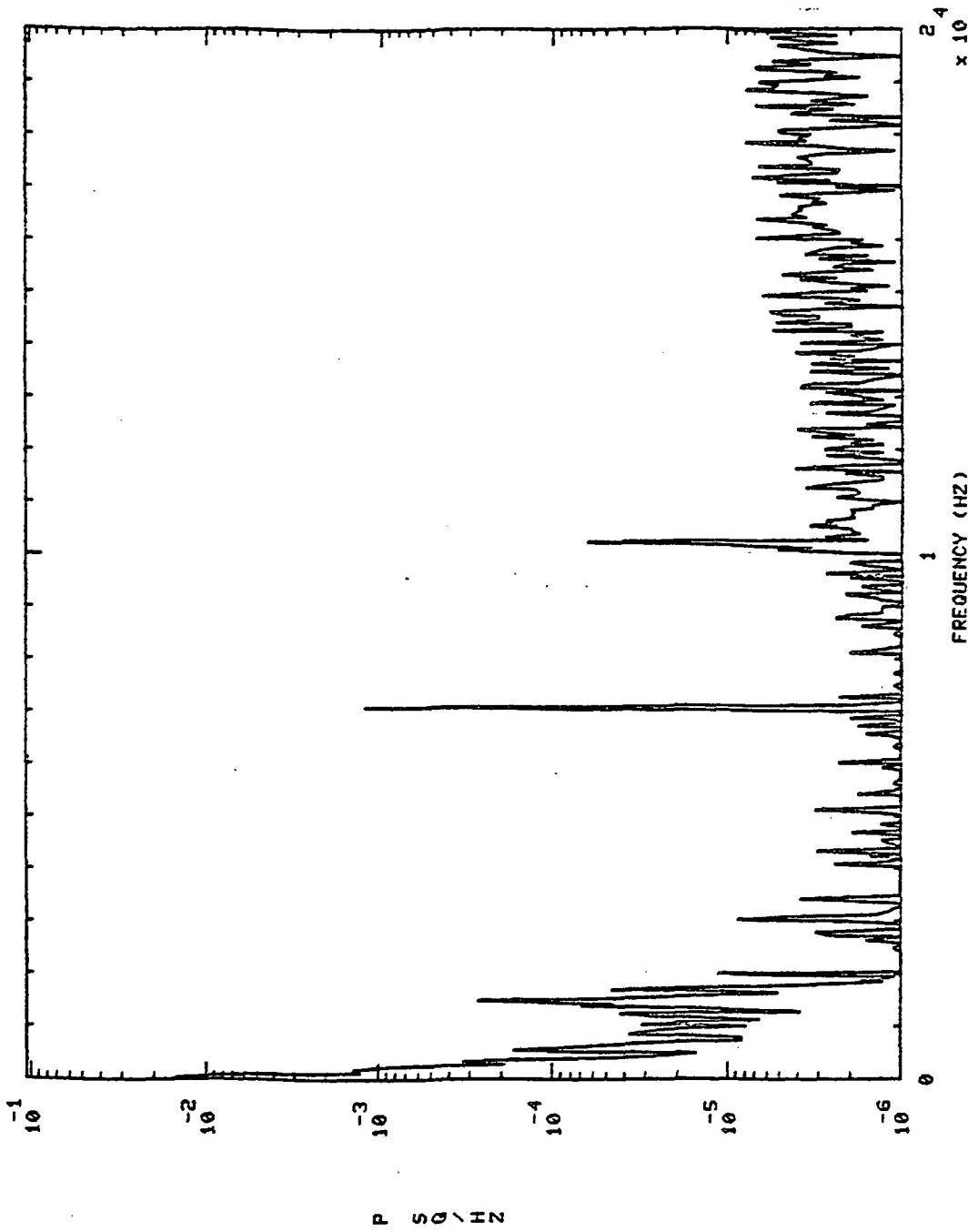


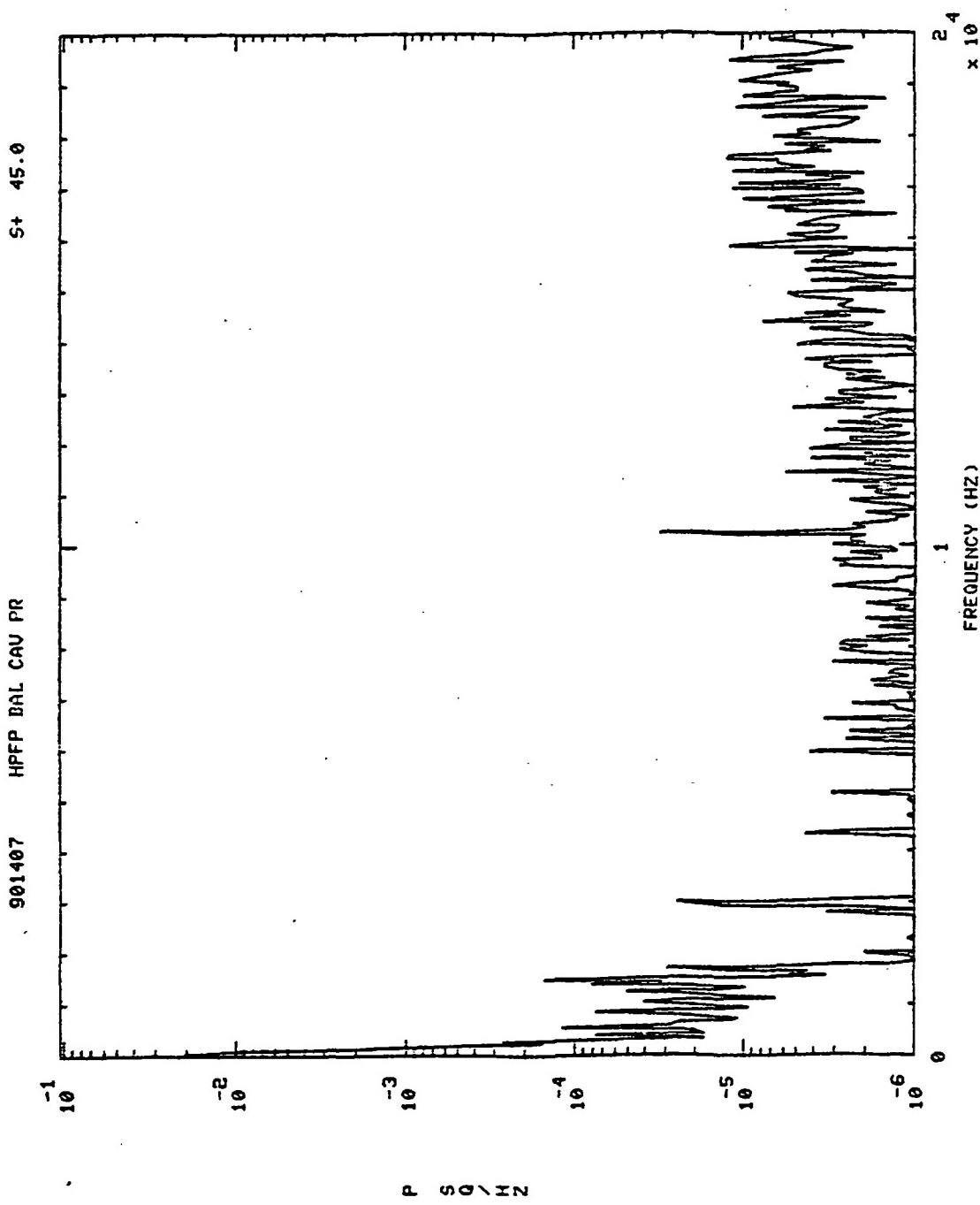
P S Q / HZ



901407 HPFP BAL CAV PR

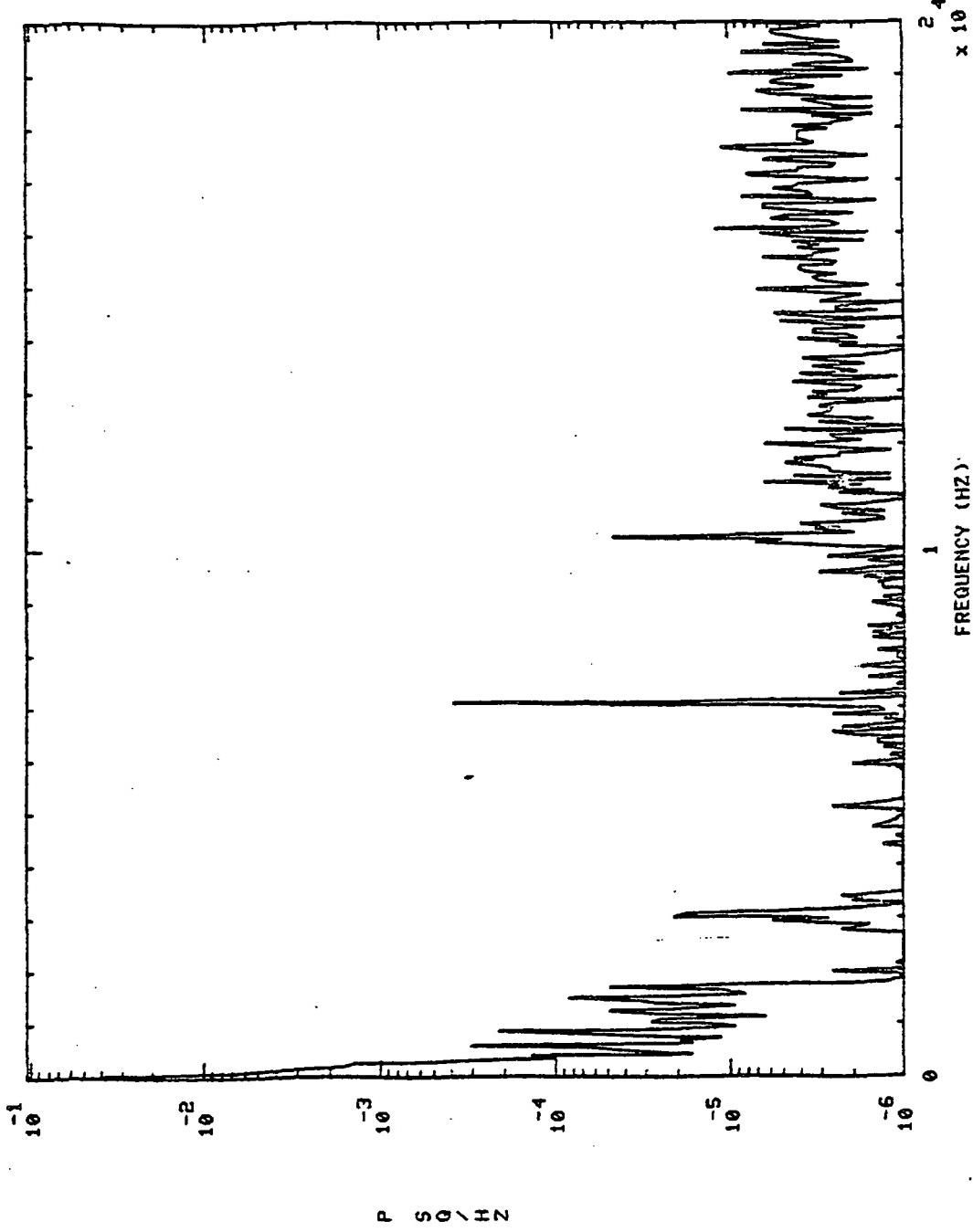
S+ 20.0

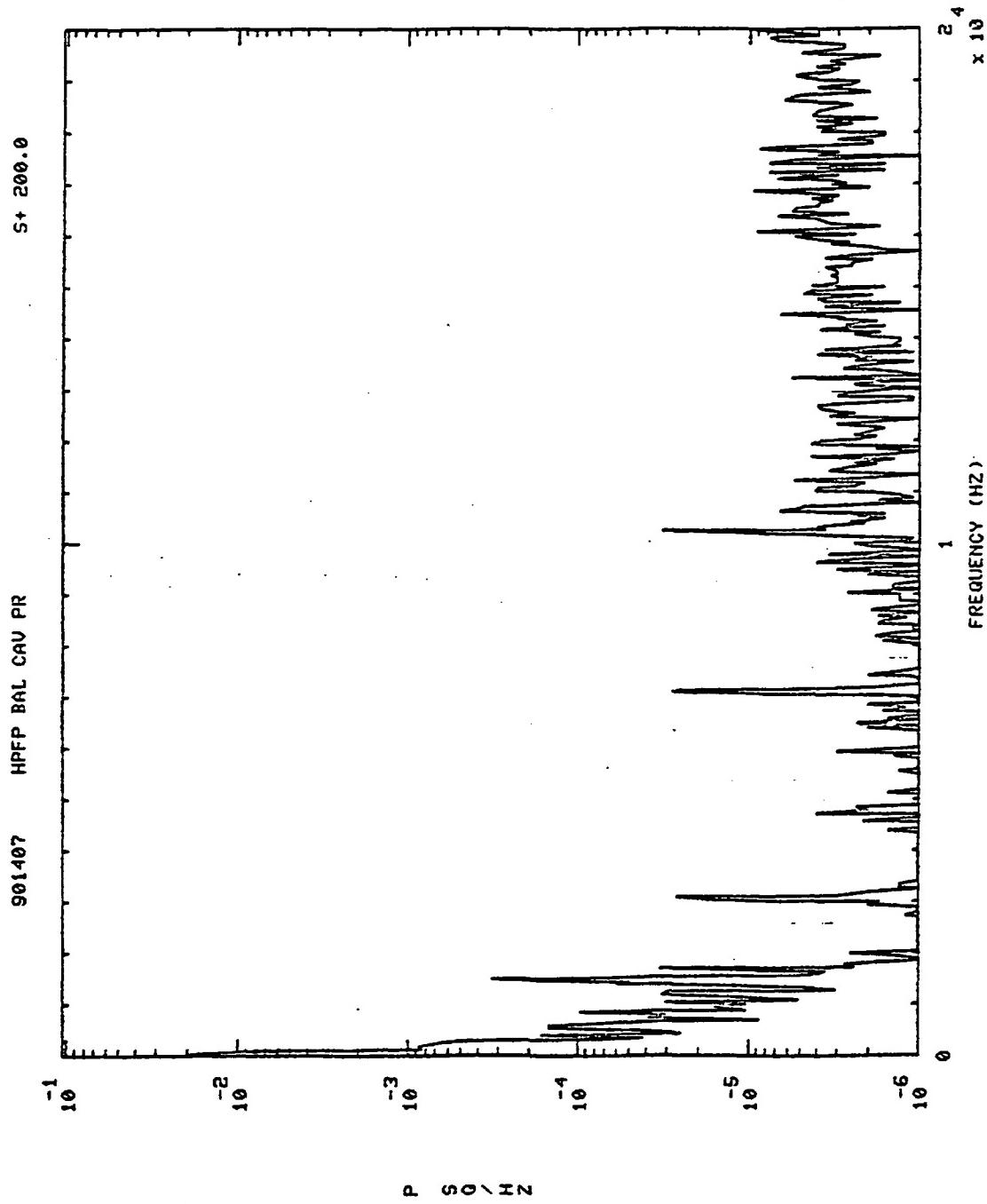




901407 HFPP BAL CAU PR

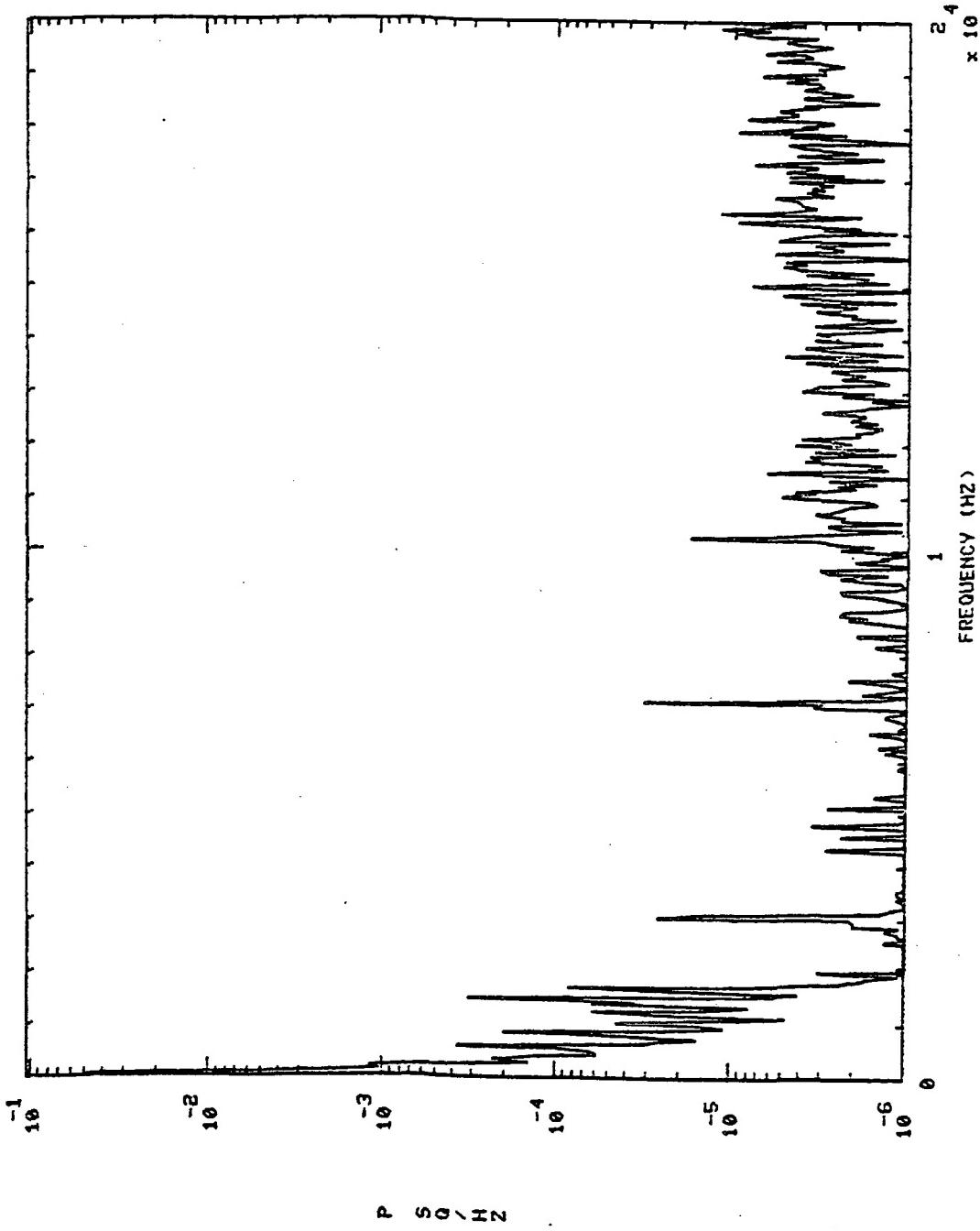
S+ 75.0

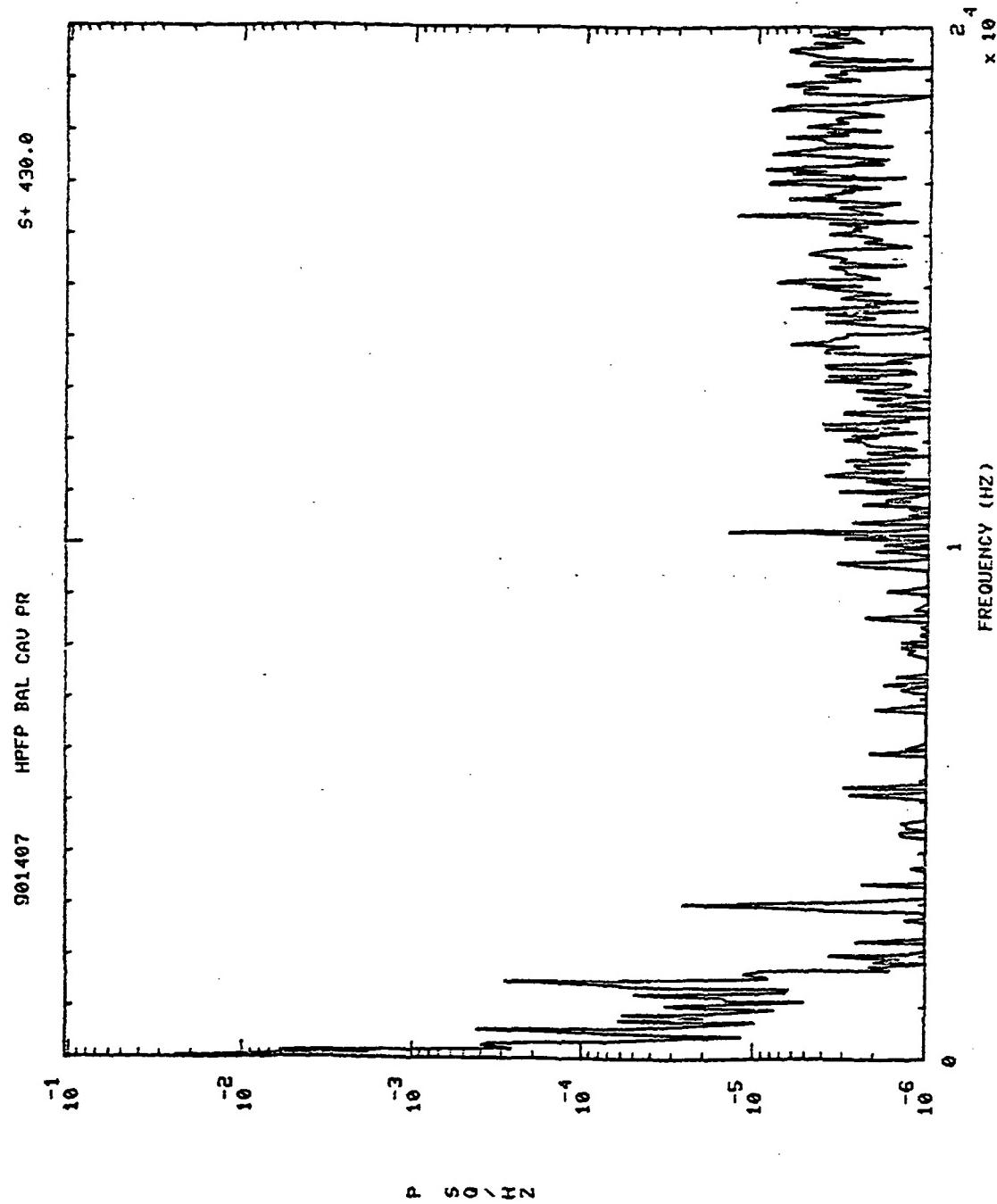




901407 HFPP BAL CAU PR

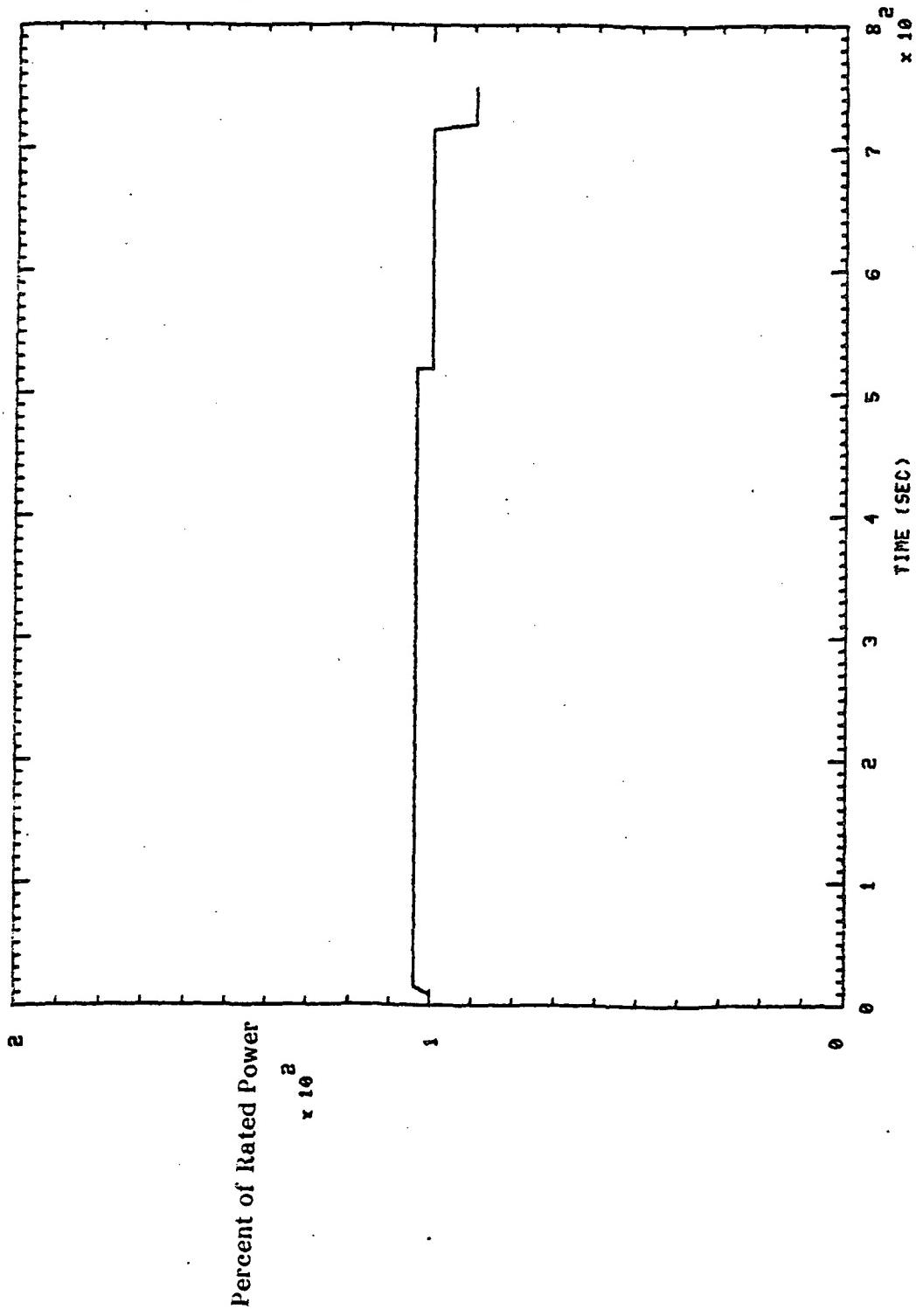
S+ 400.0

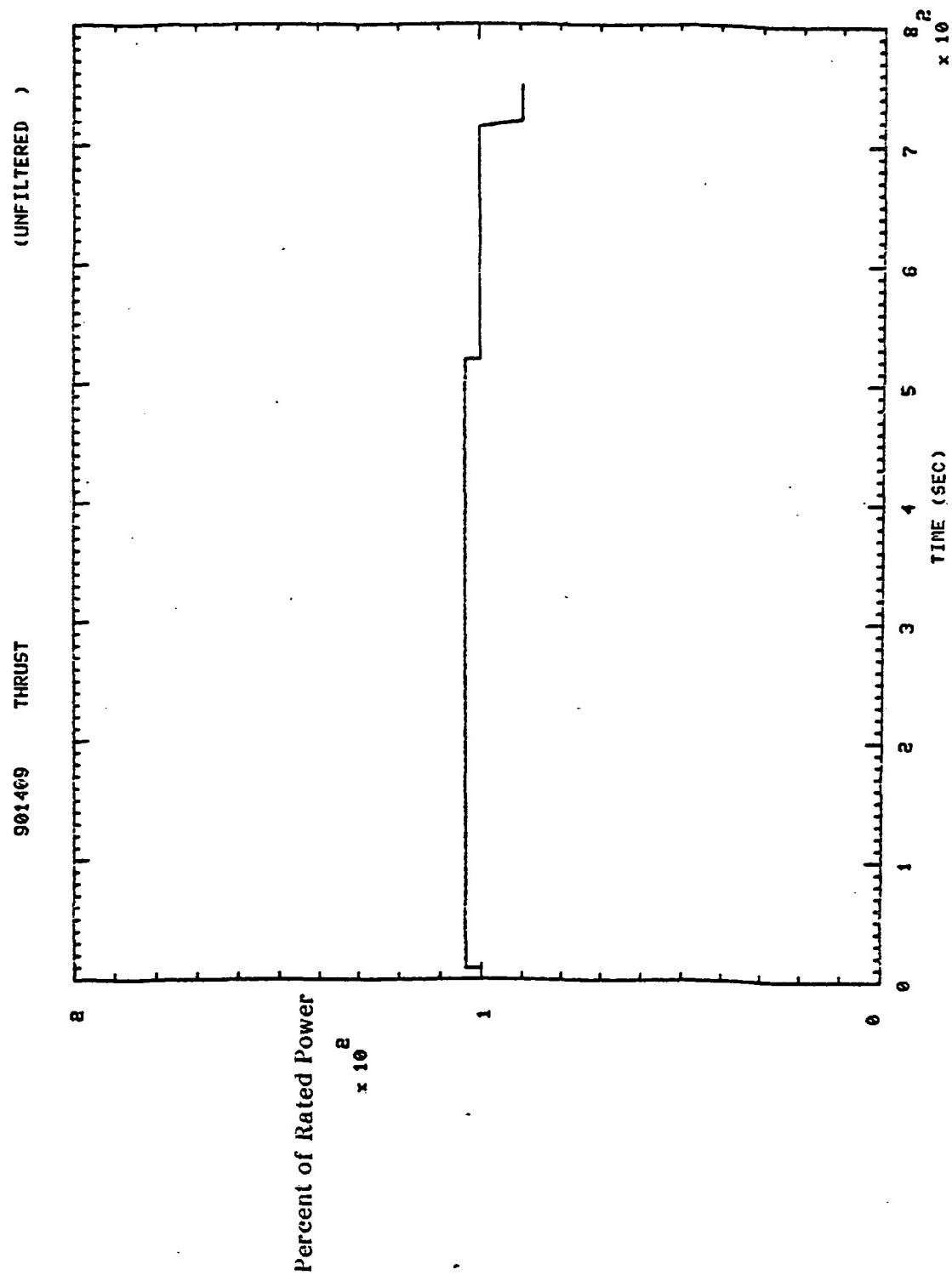




901408 THRUST

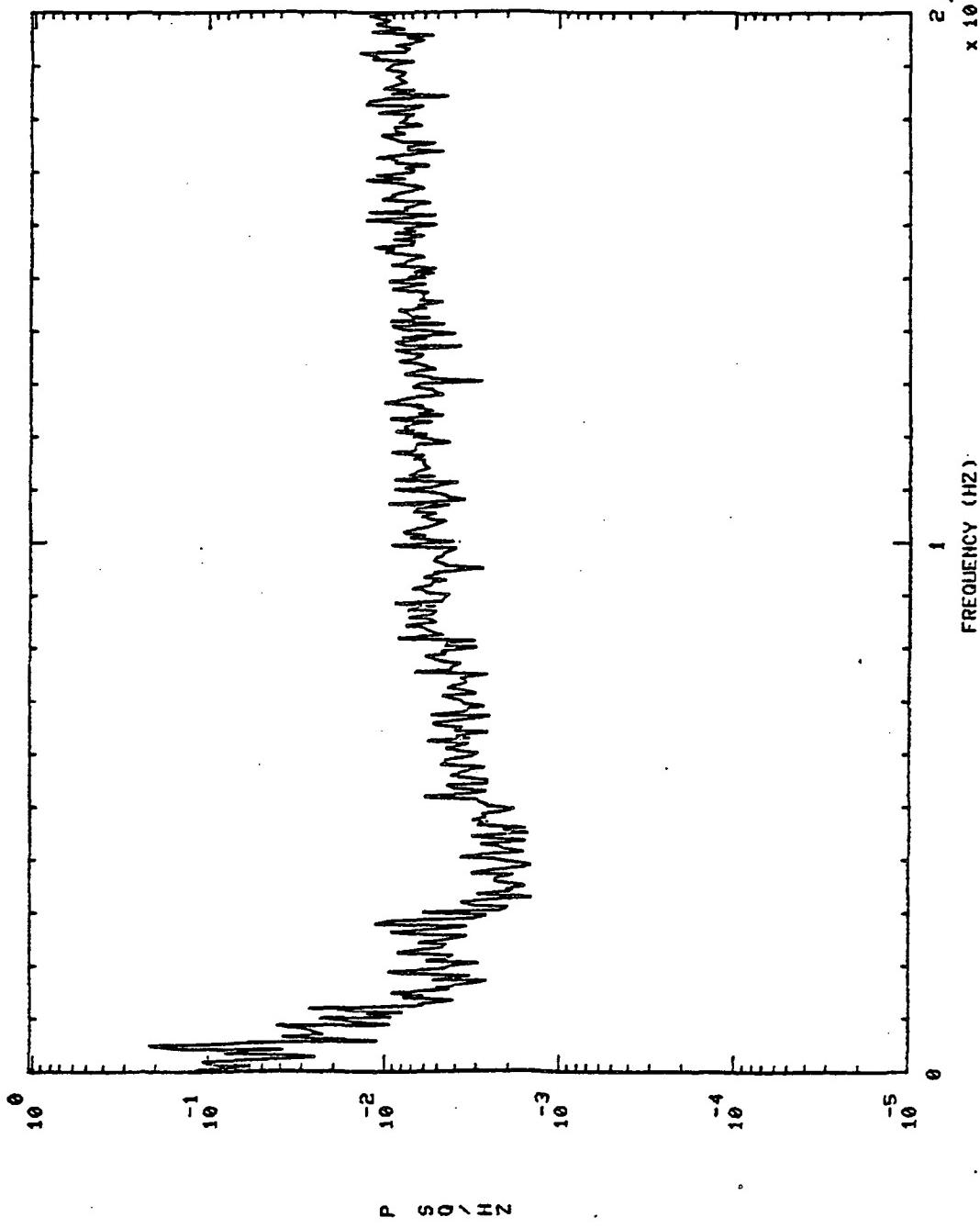
(UNFILTERED)

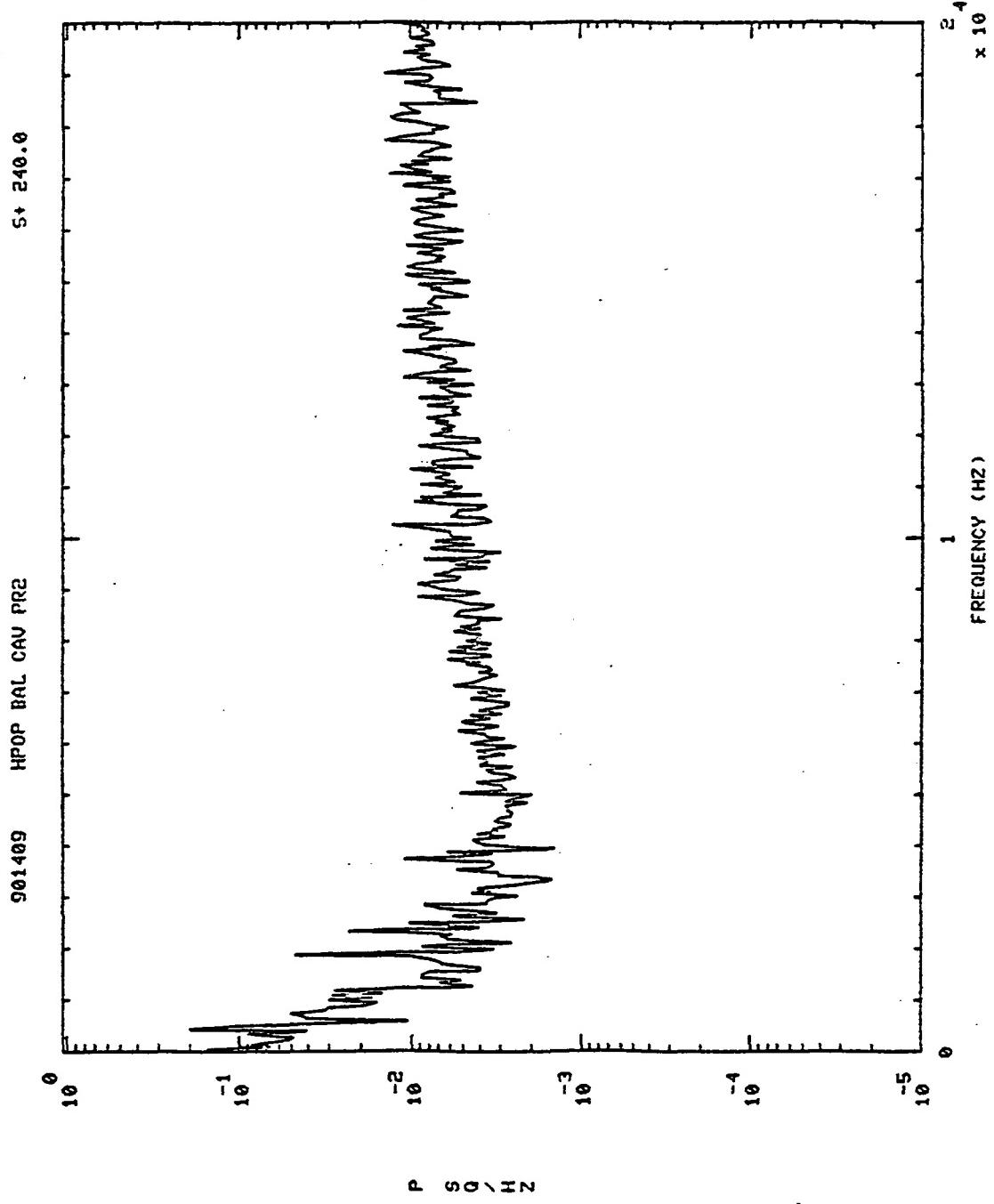




901409 HPOP BAL CAV PR2

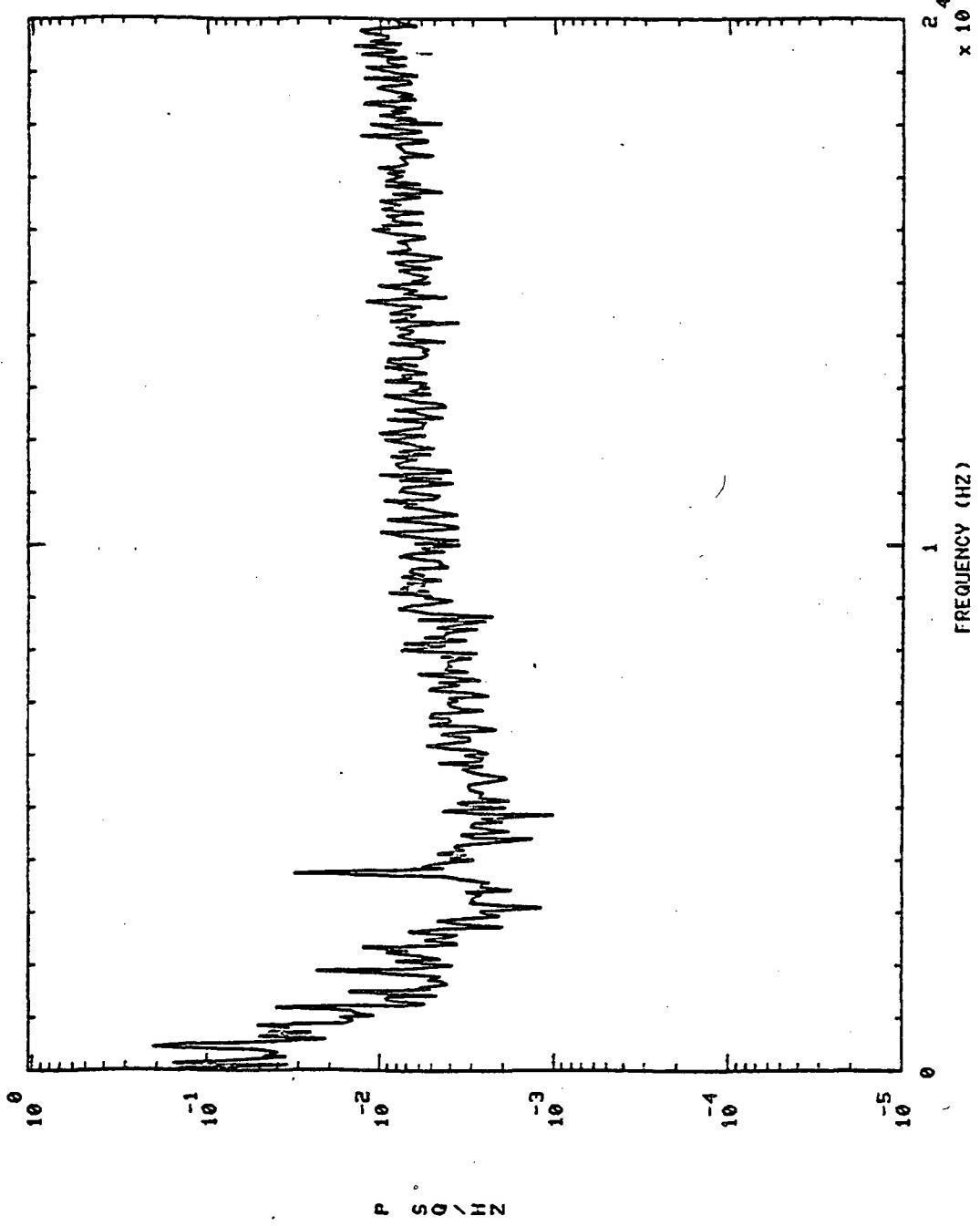
S+ 15.0



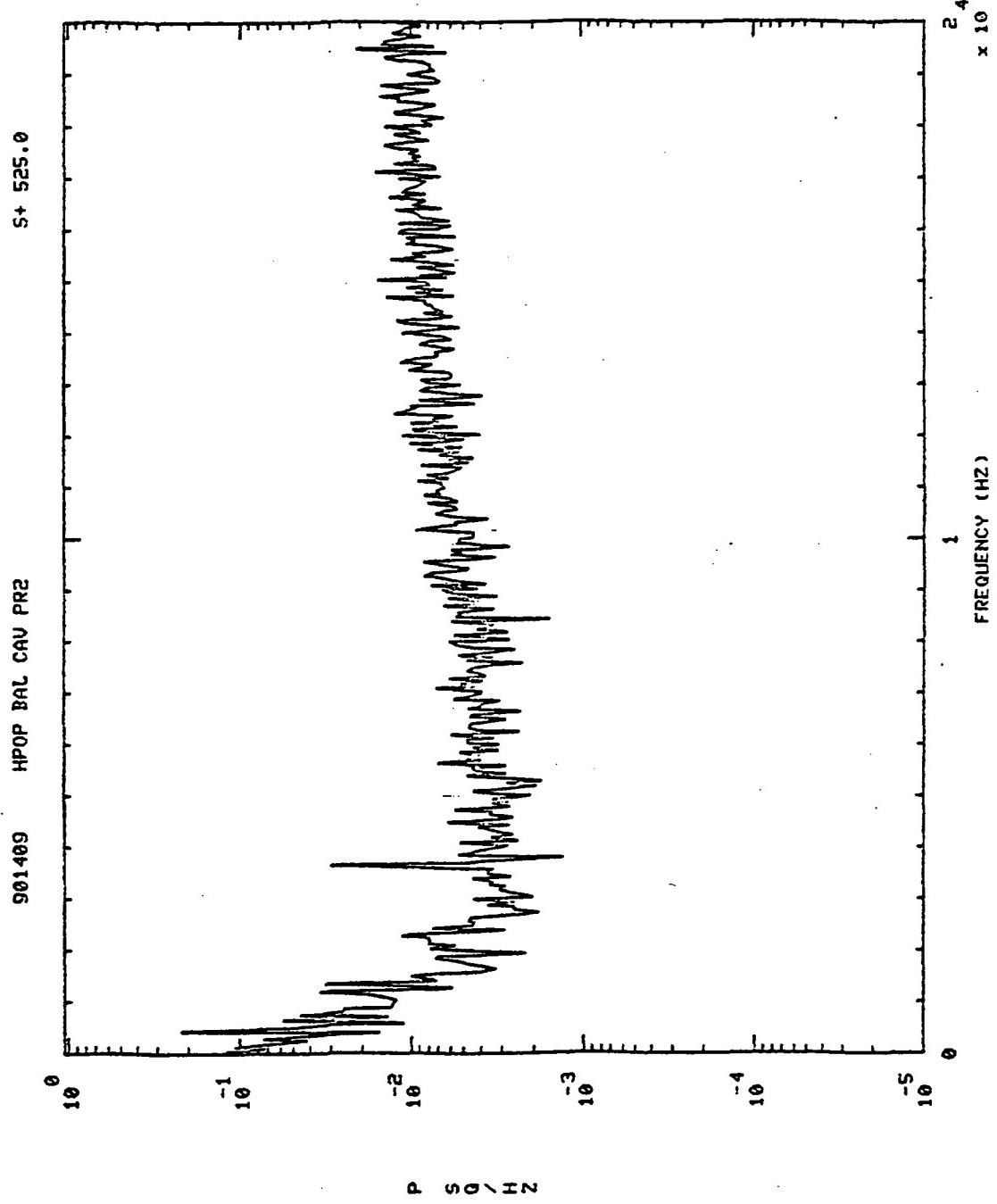


S+ 500.0

901409 HP0P BAL CAU PR2

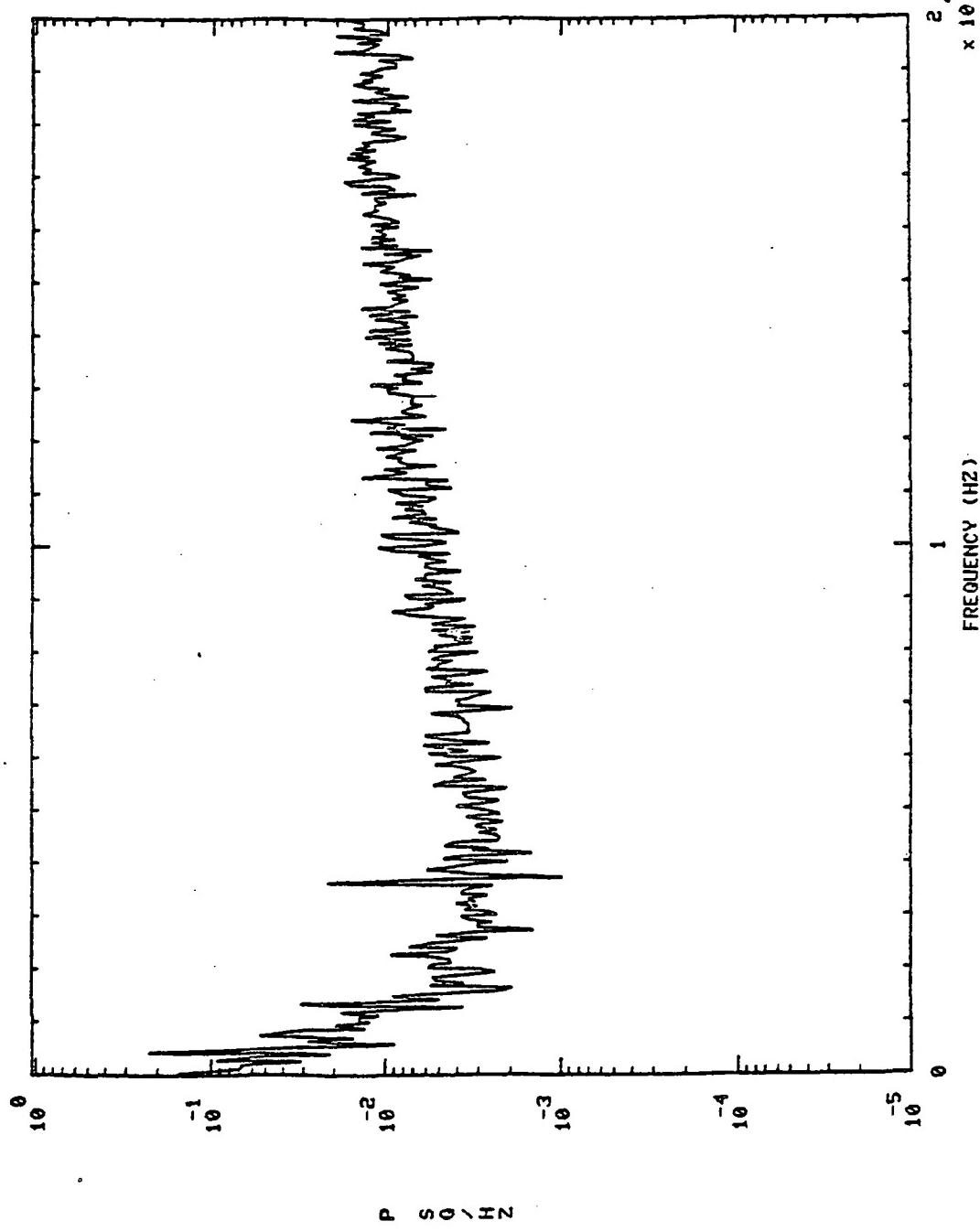


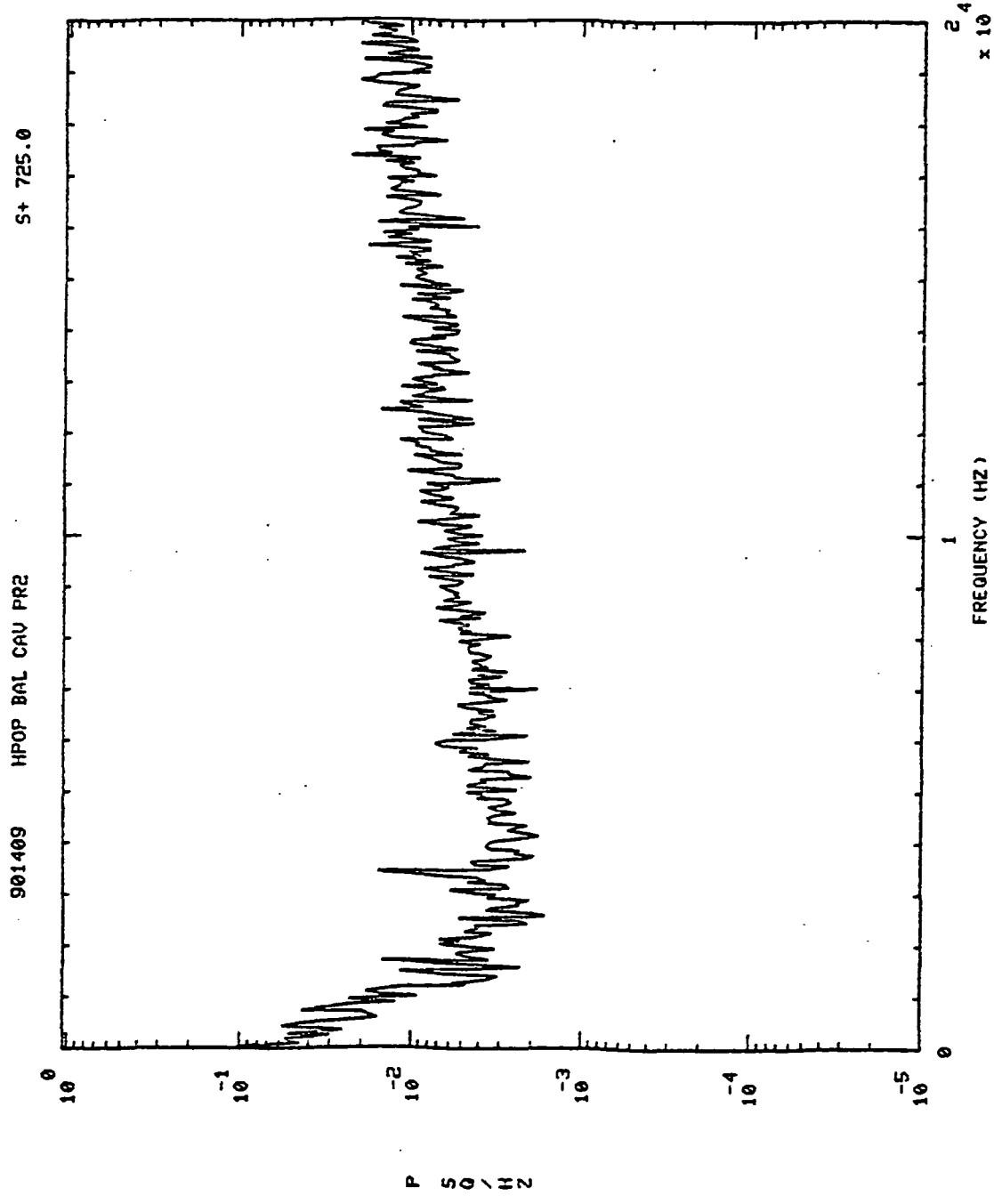
P
S
Q / HZ



S+ 765.0

961409 HPOP BAL CAU PRS

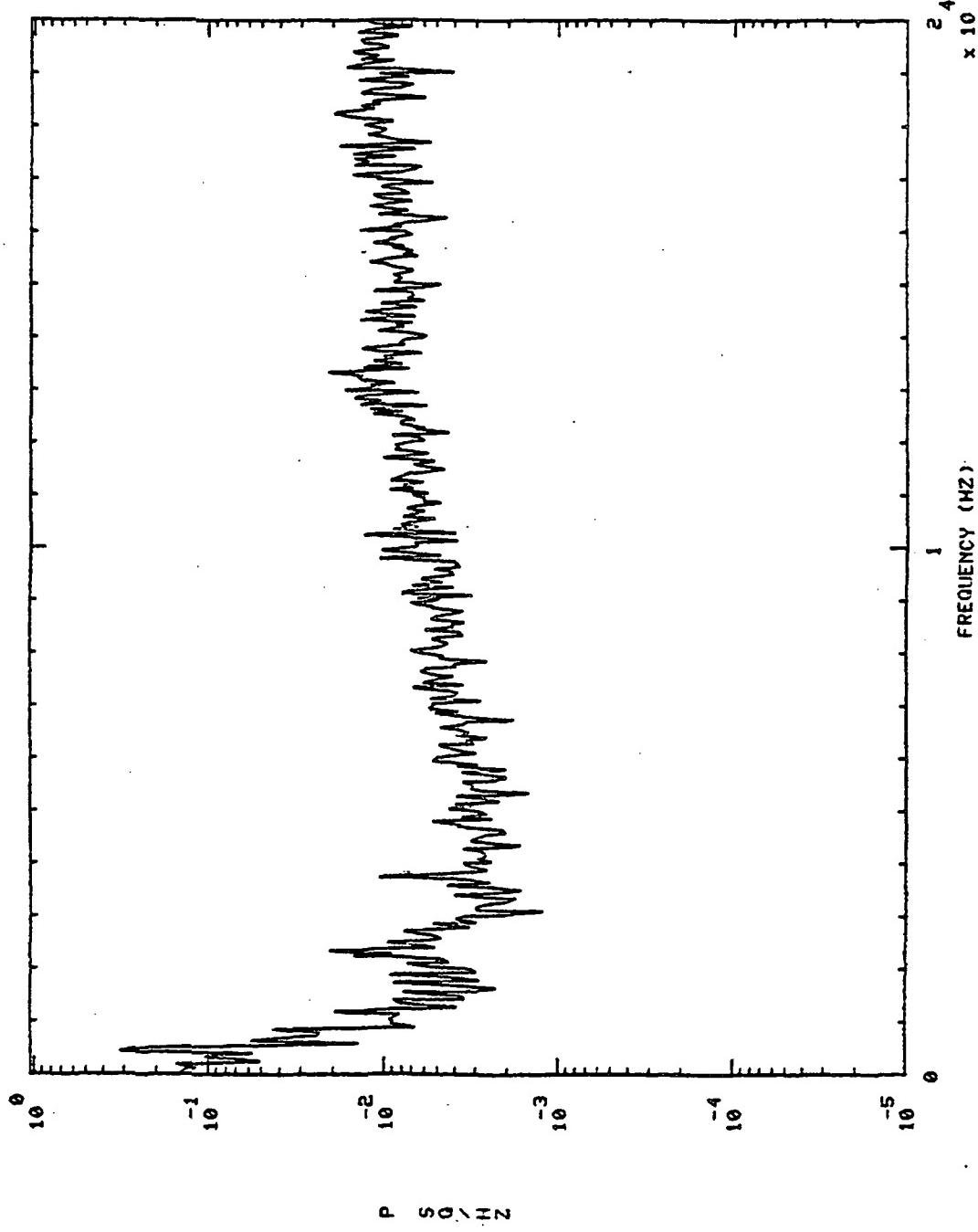


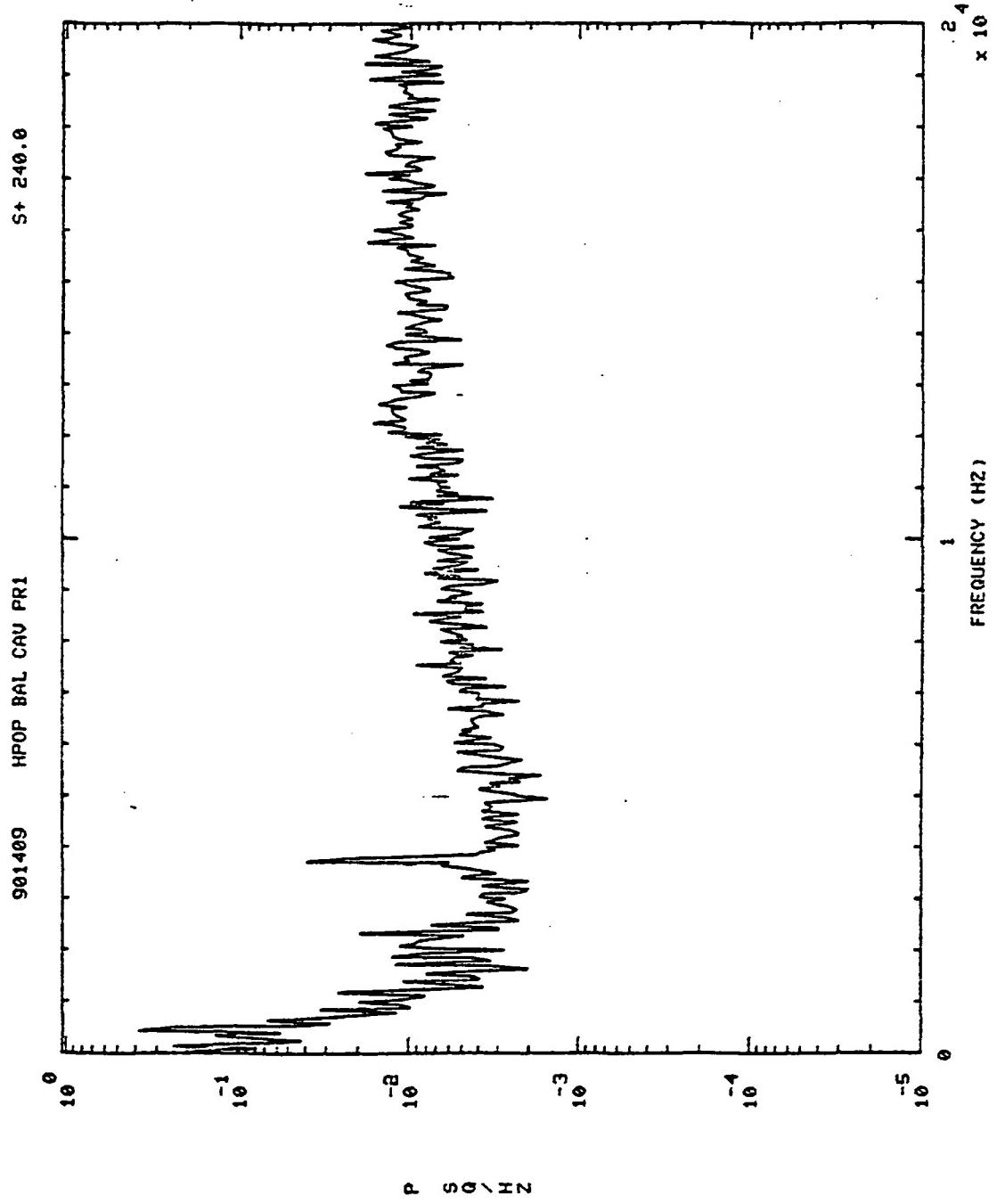


901469

S+ 15.0

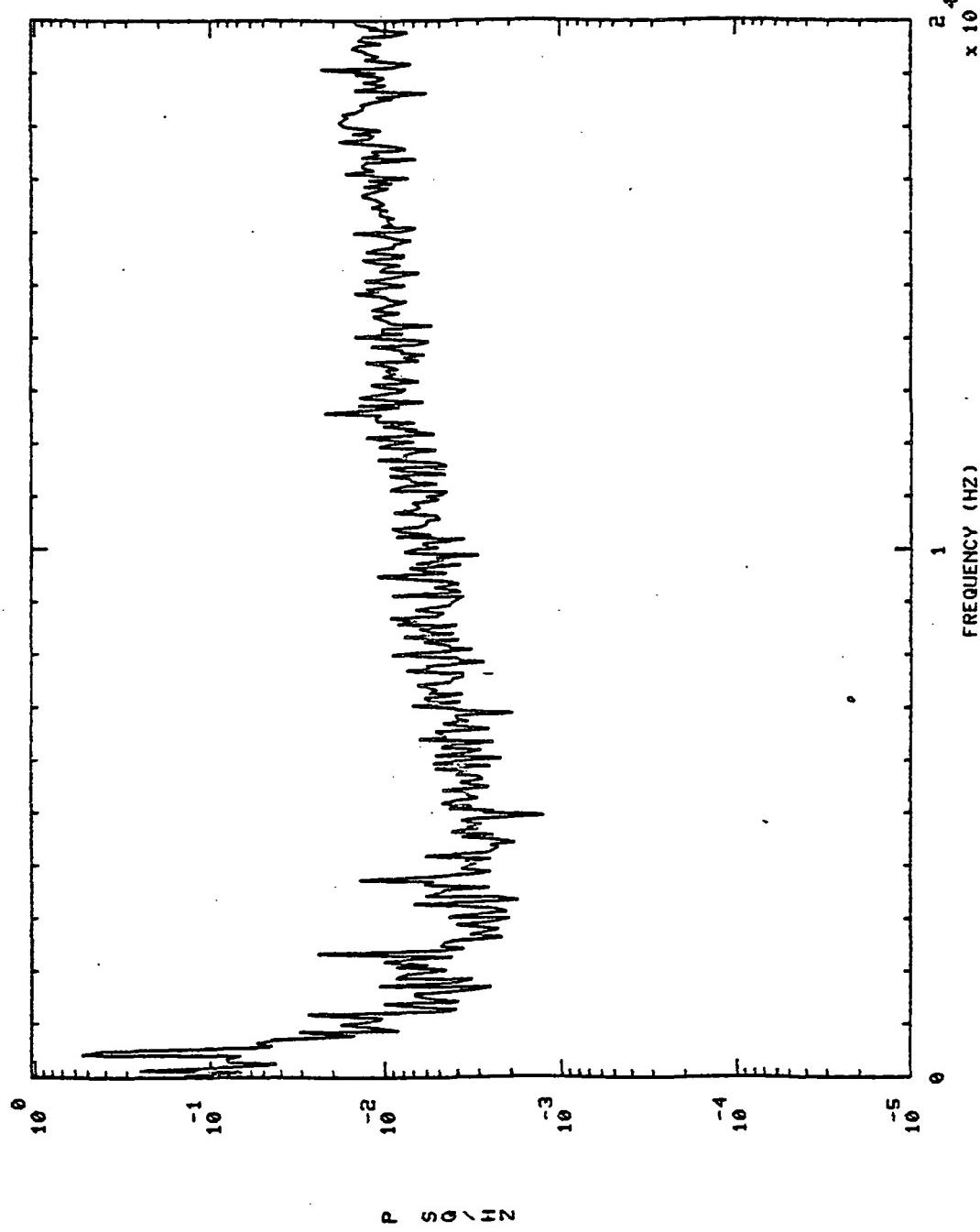
HPOP BAL CAU PR1





S+ 500.0

901409 HP0P BAL CAV PR1



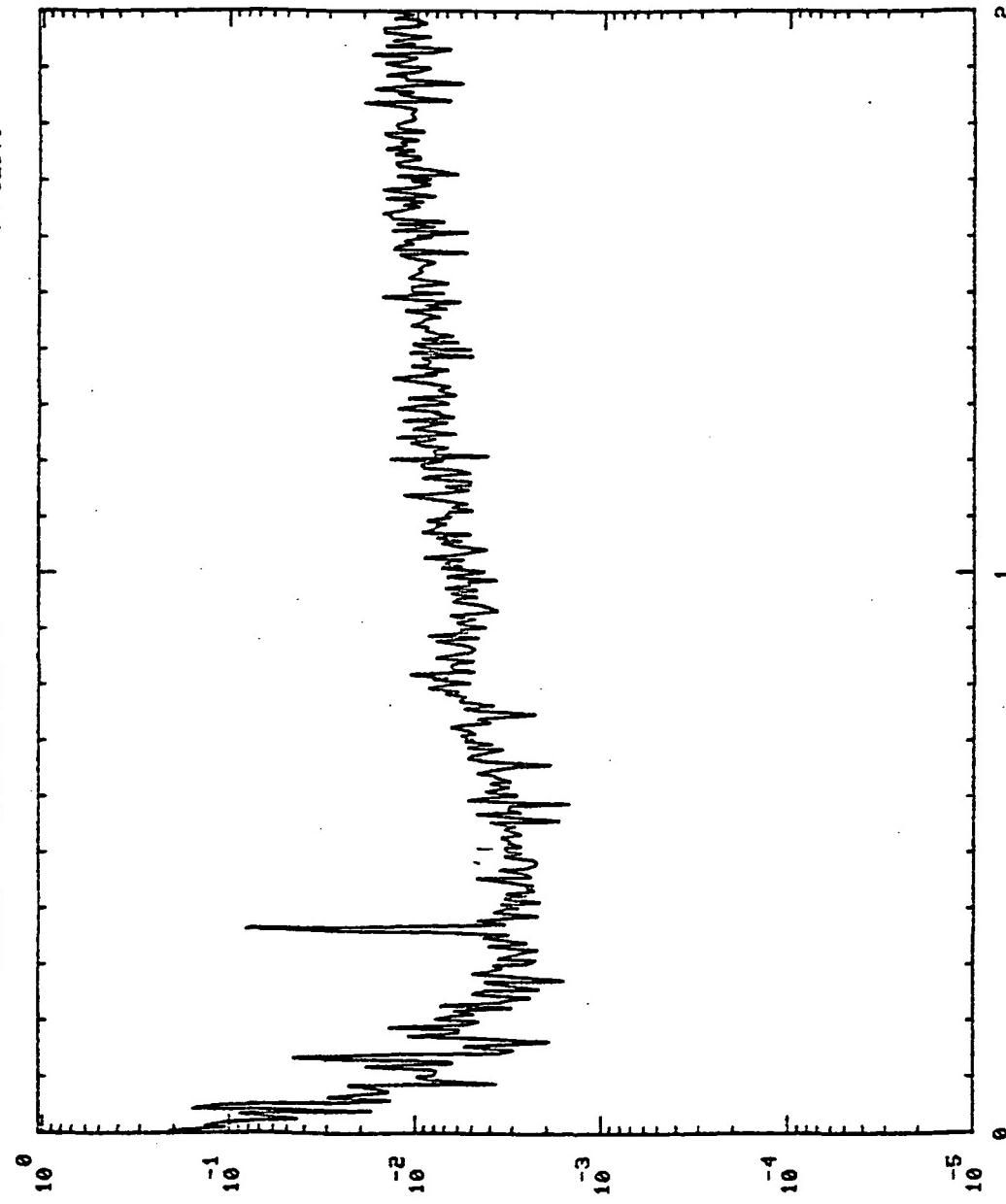
901409 HPOP BAL CAV PR1

S+ 525.0

P S G / Hz

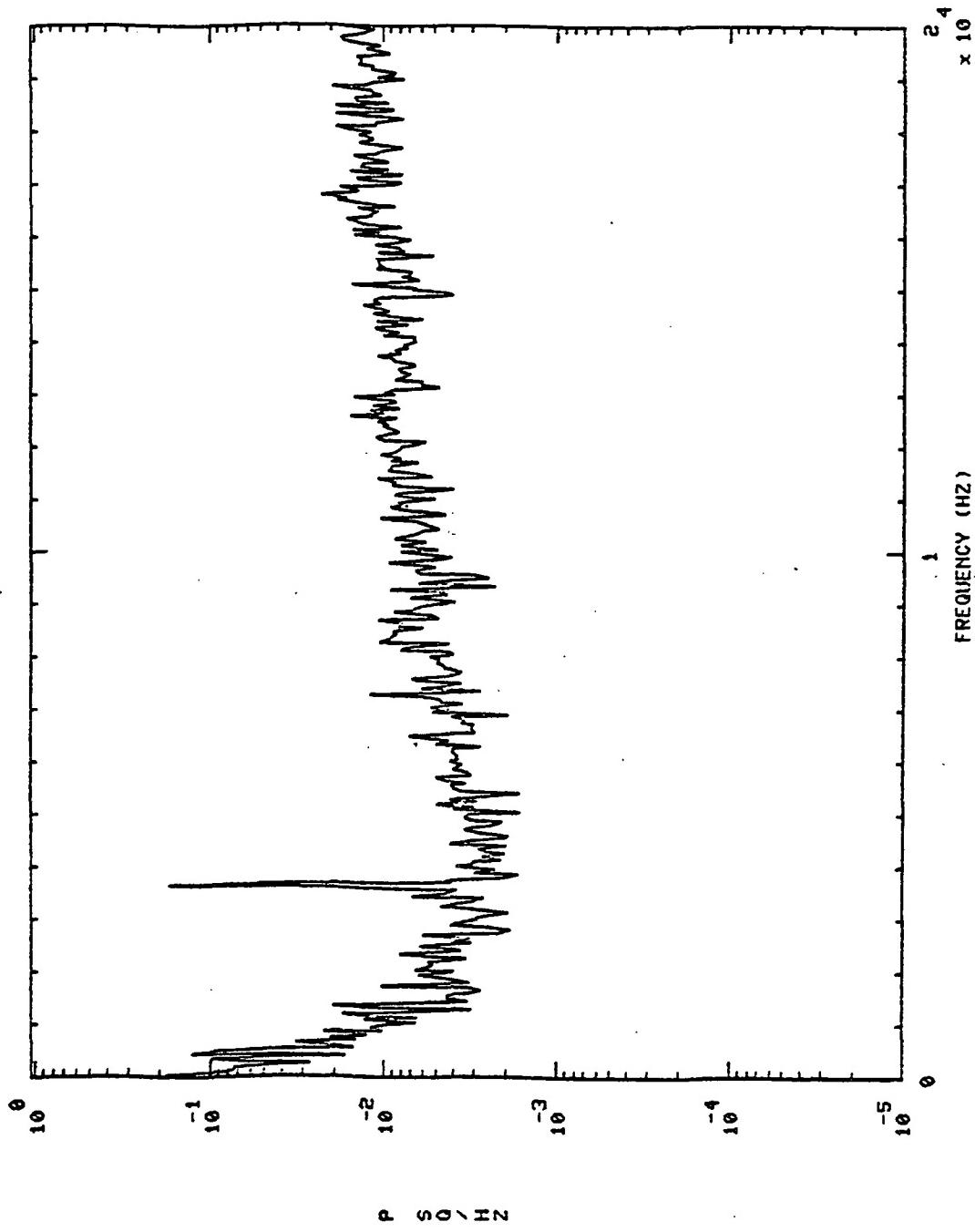
1
FREQUENCY (HZ)
 $\times 10^4$

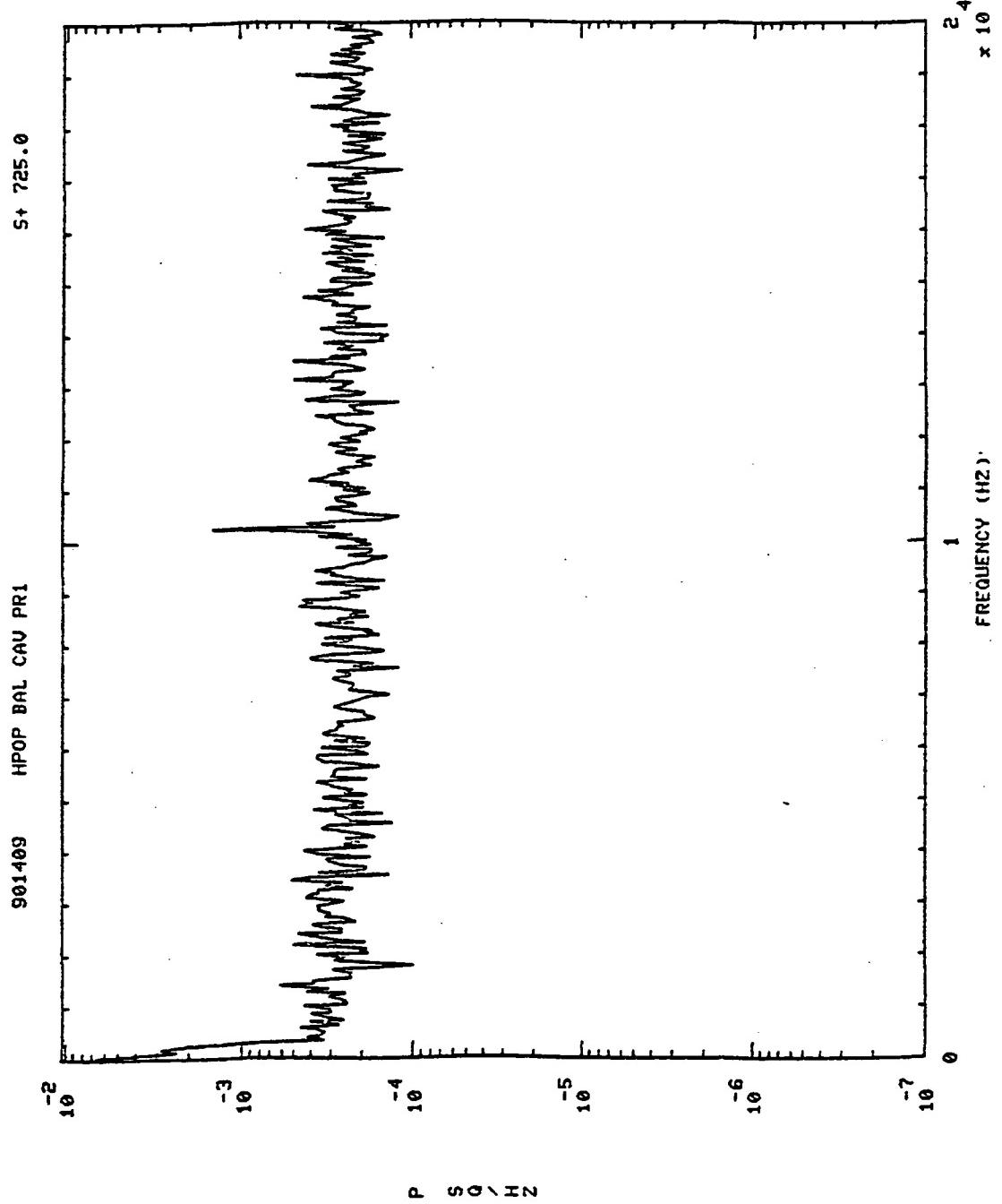
2
 $\times 10^4$

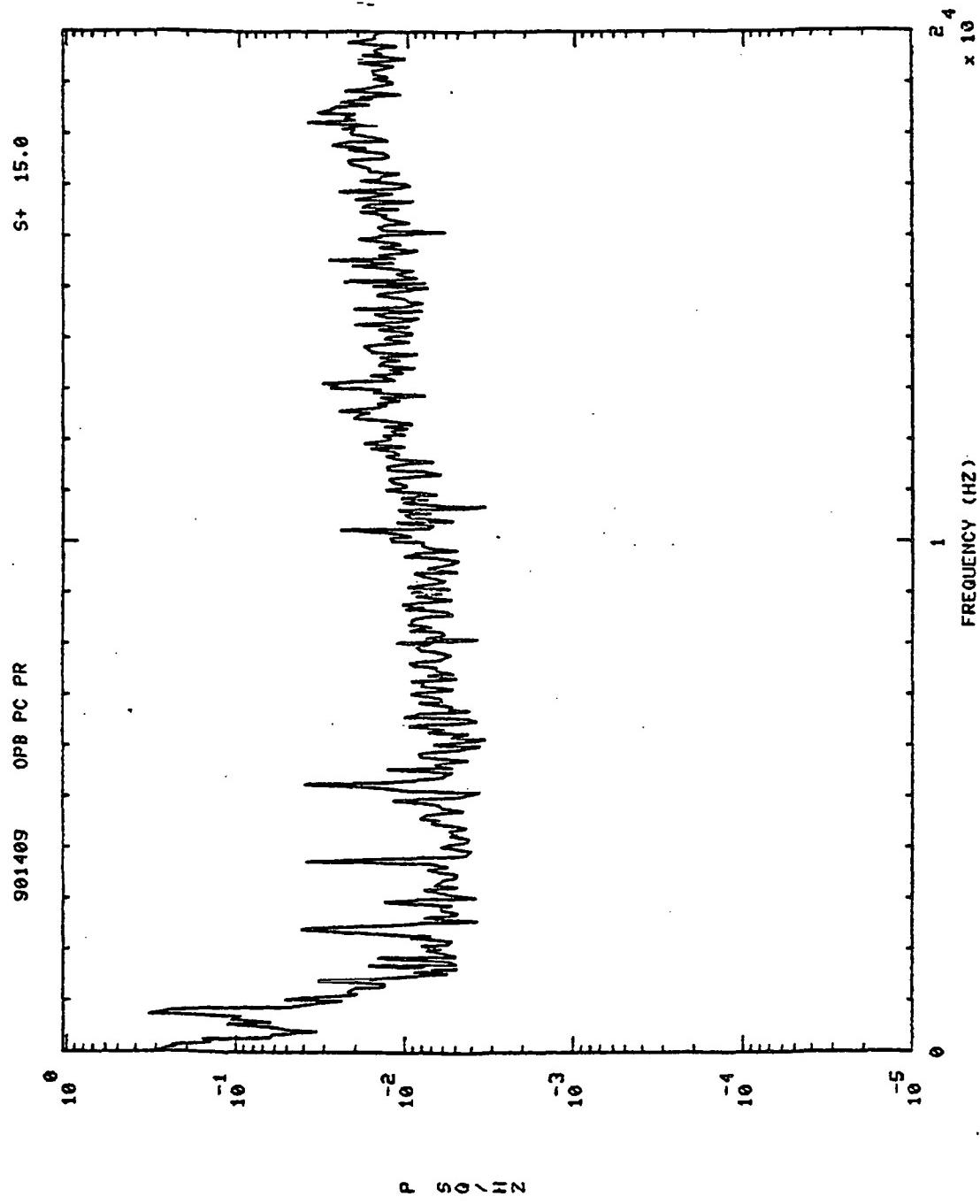


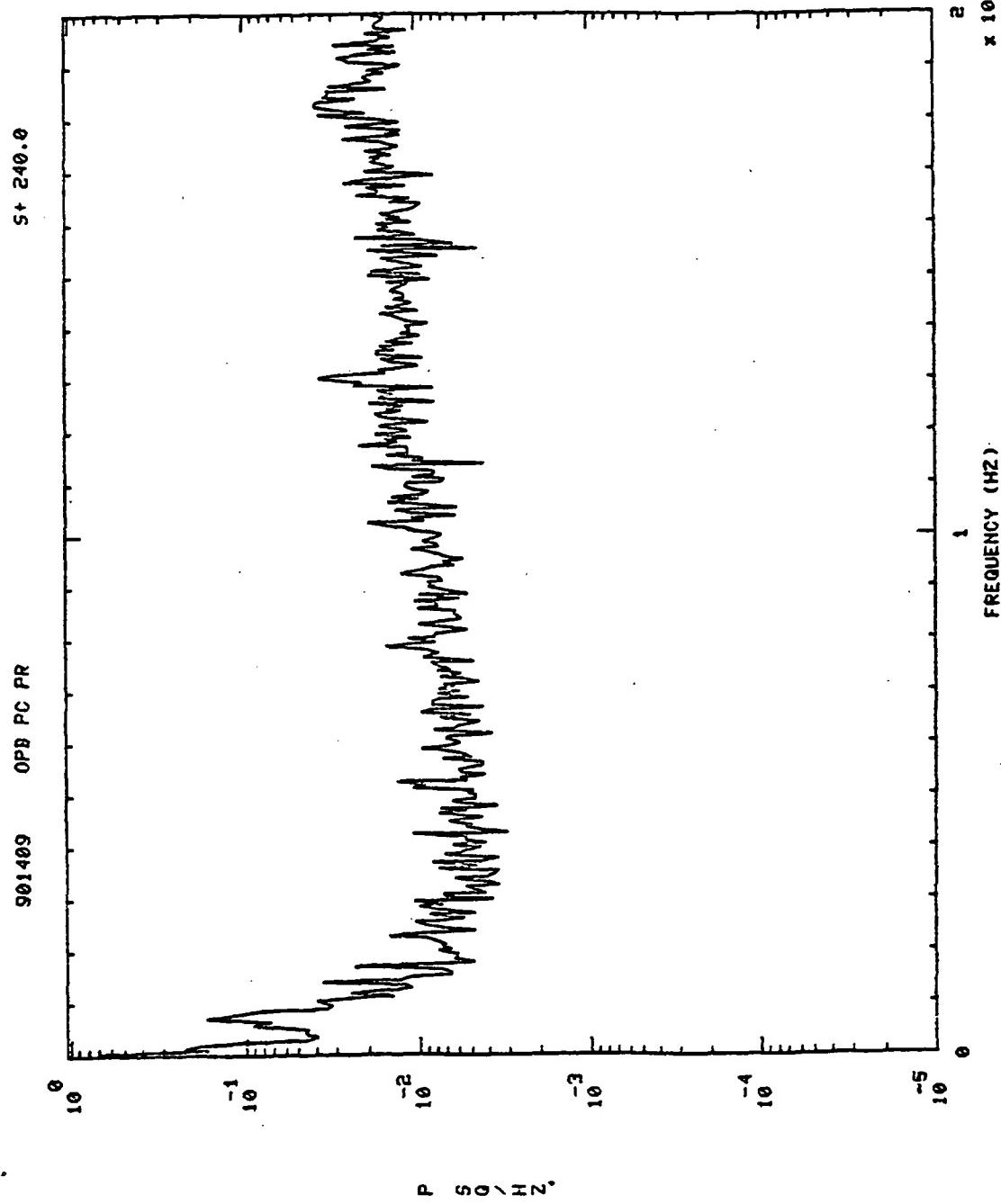
901409 HP0P BAL CAV PR1.

S+ 705.0



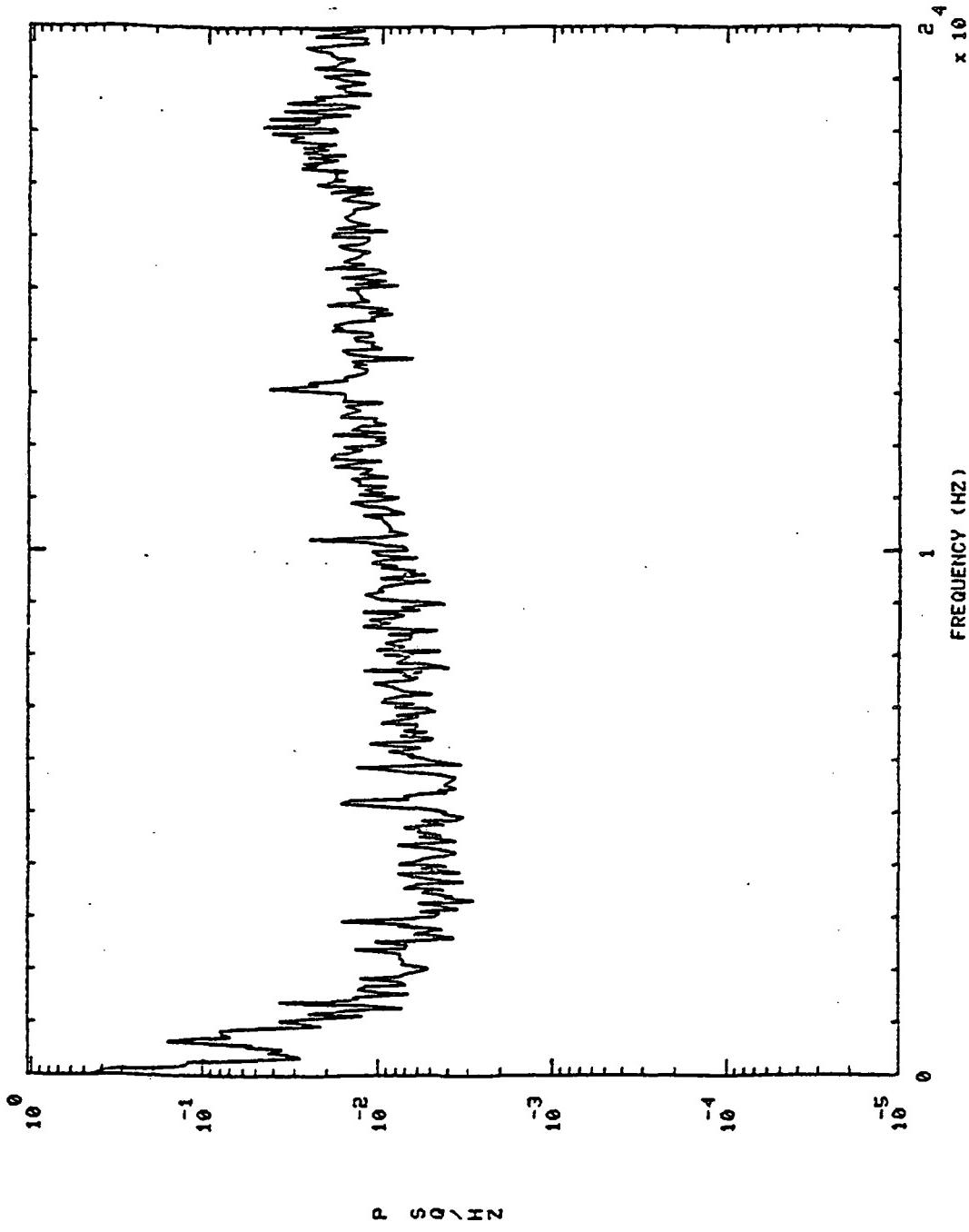


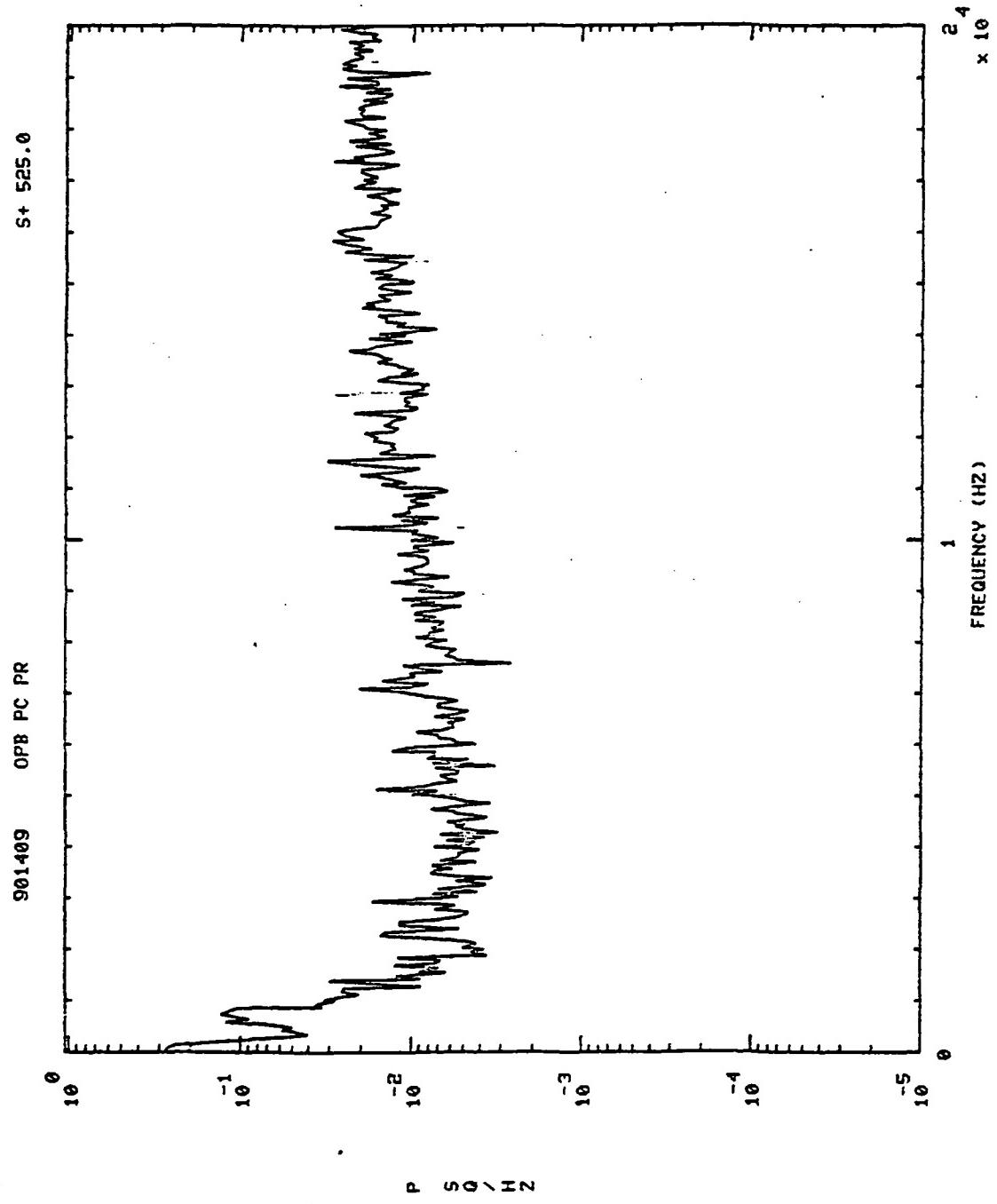




S+ 500.0

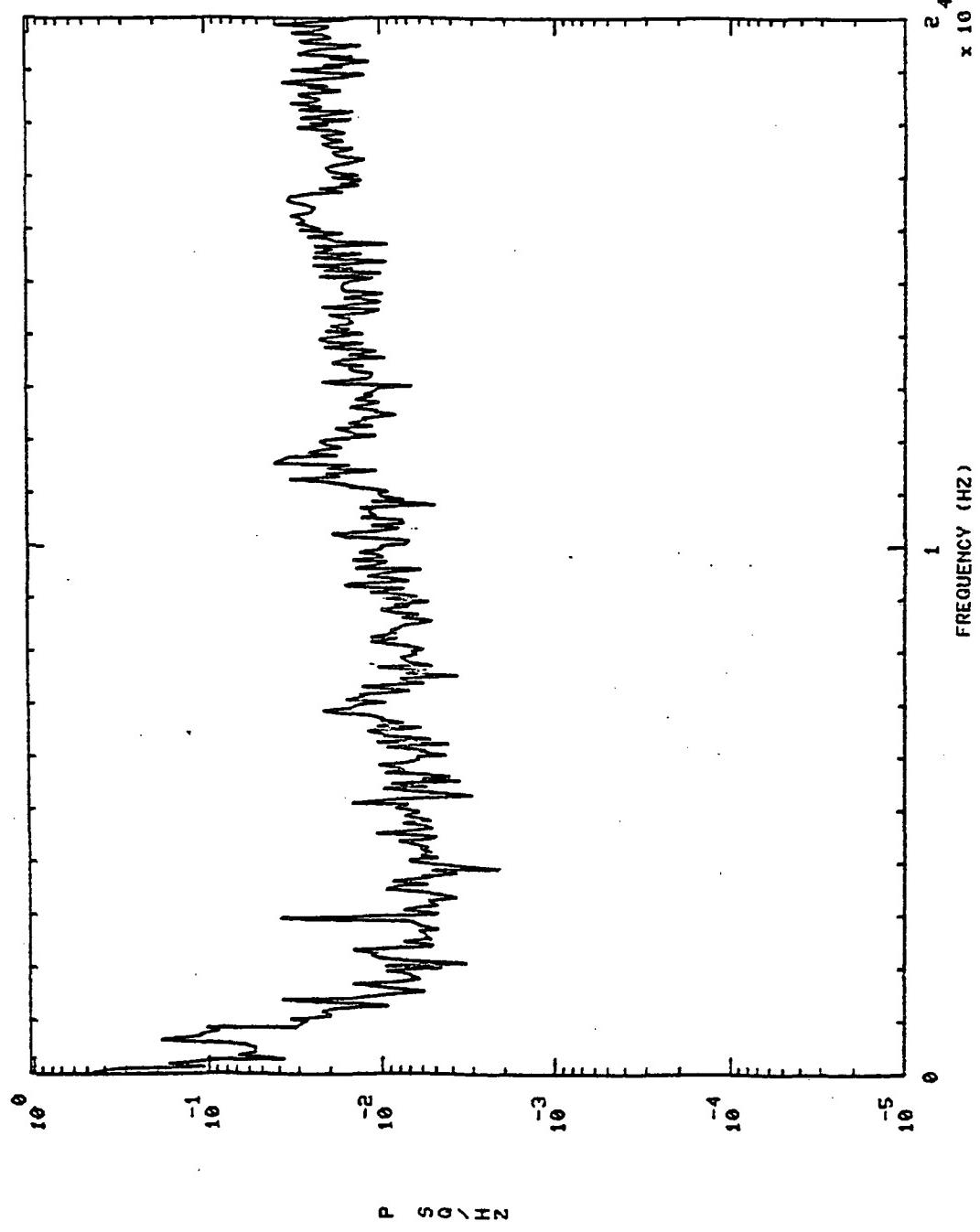
901409 OPB PC PR

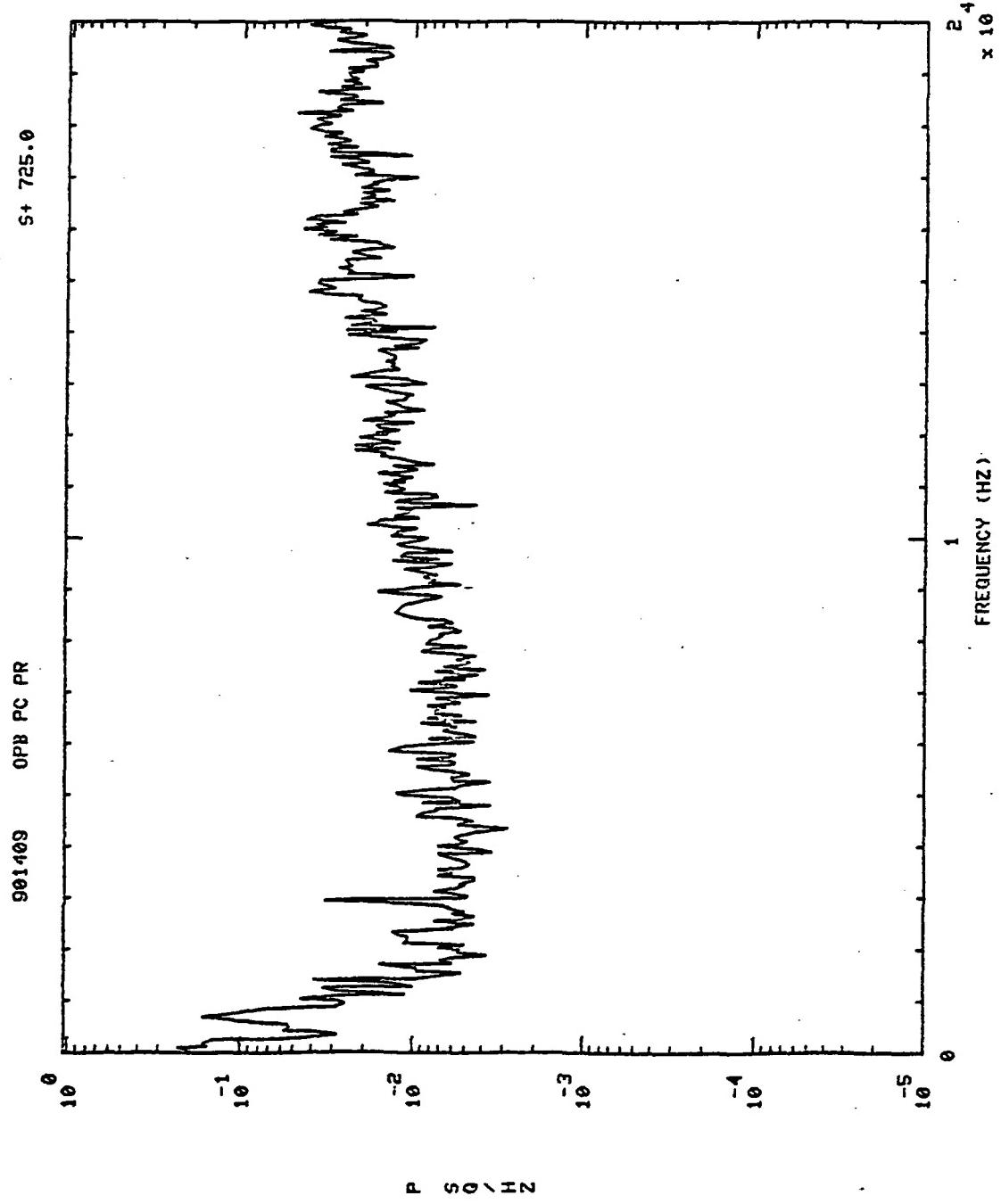




S+ 705.0

901409 OPB PC PR

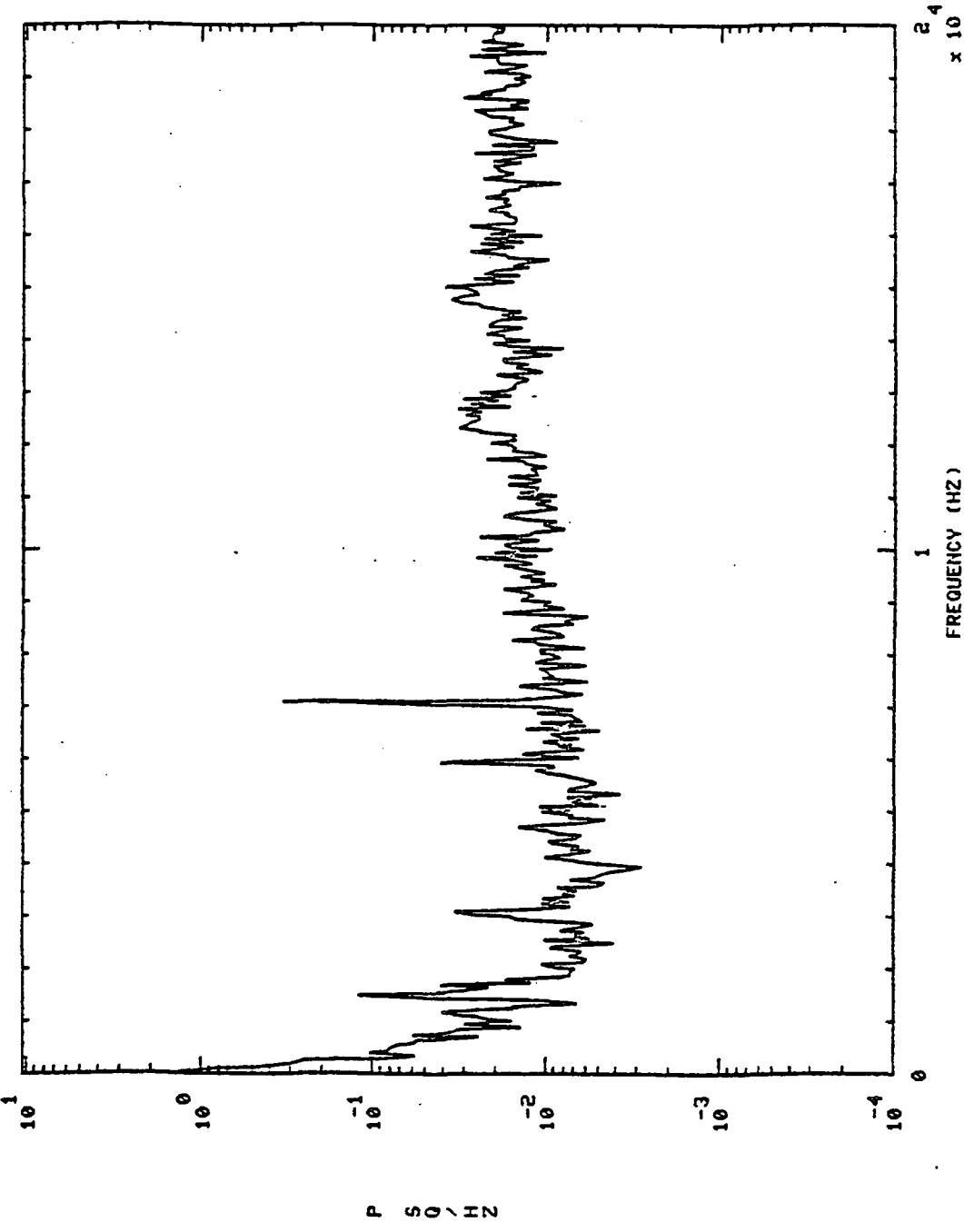


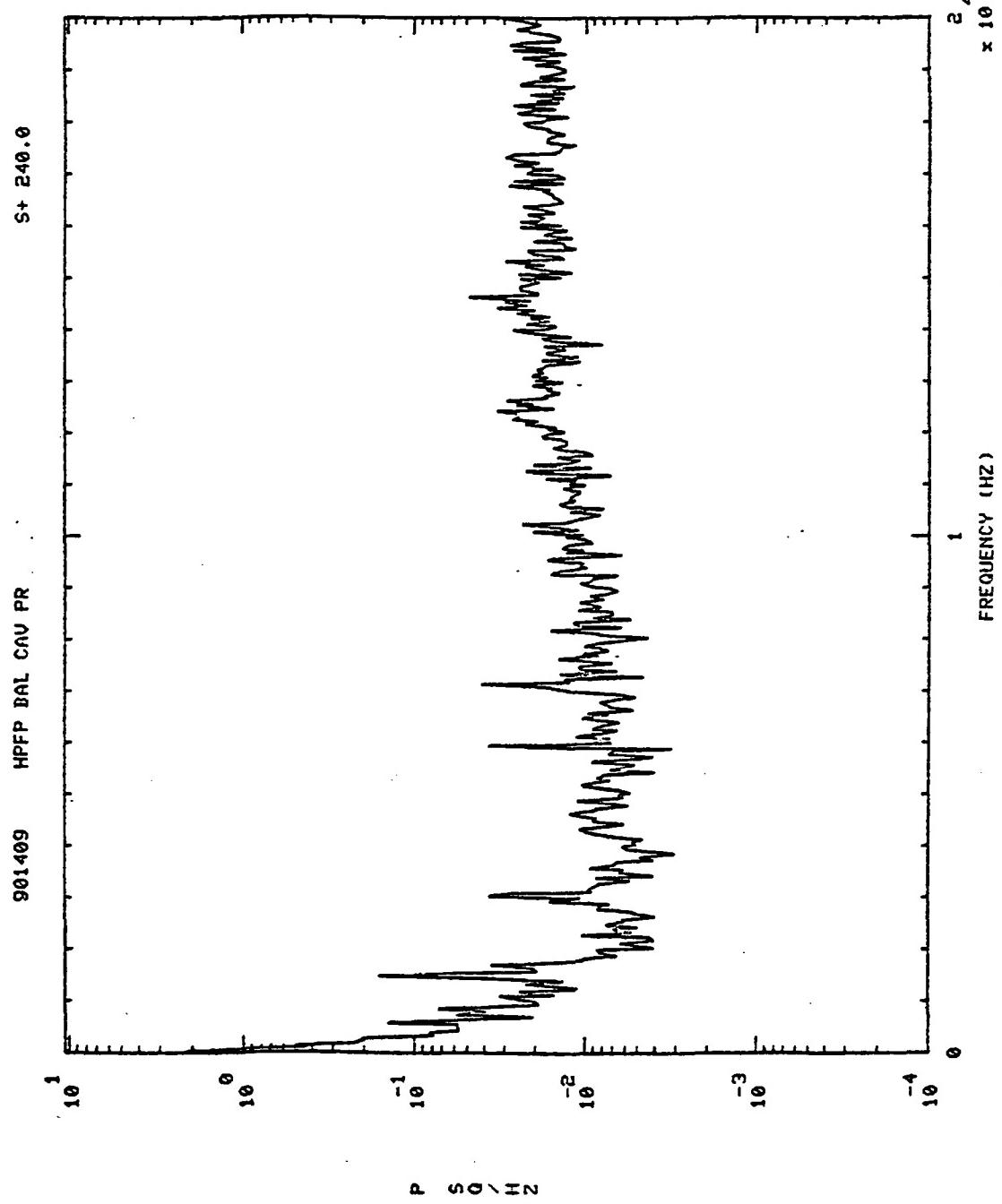


901409

S+ 15.0

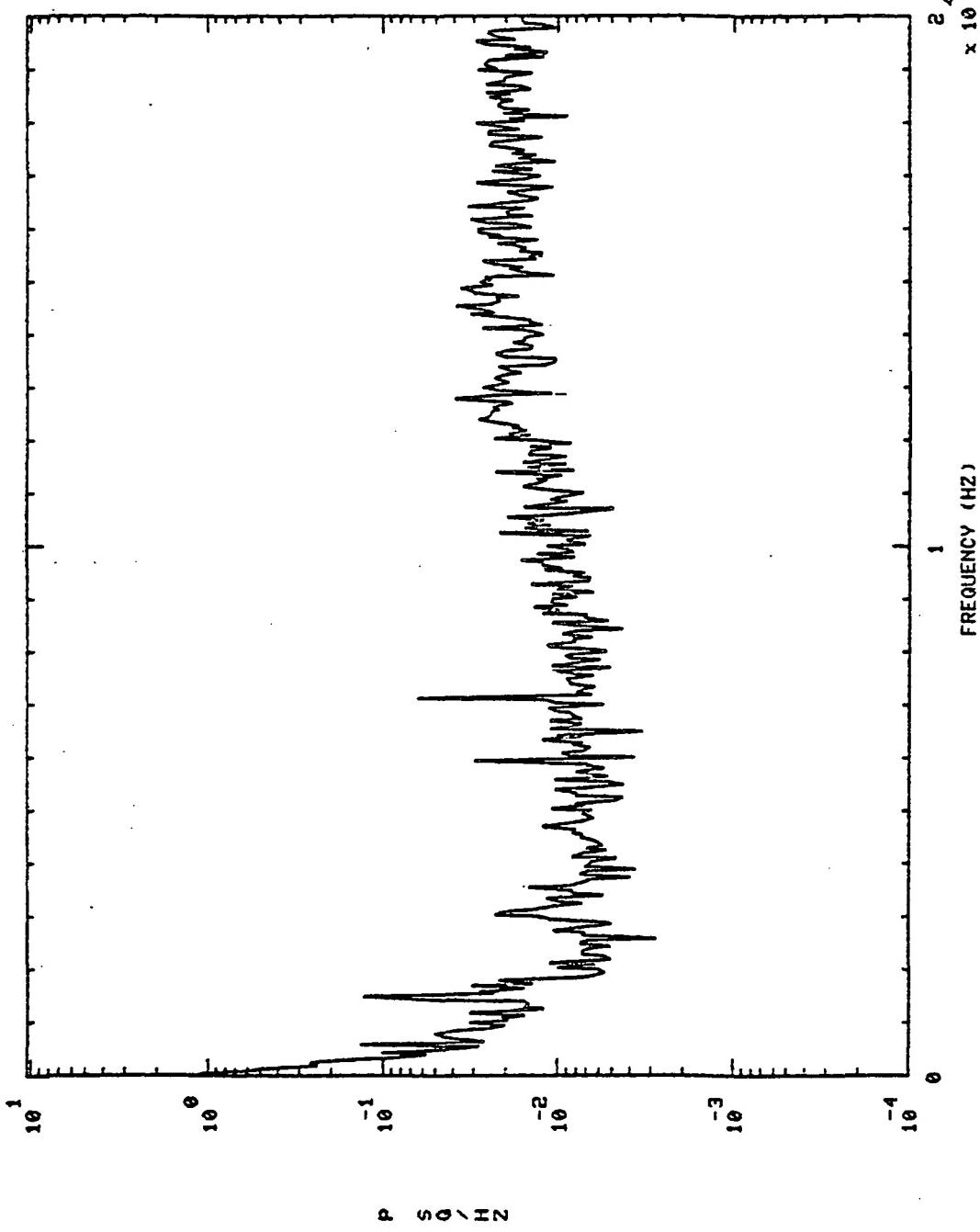
HPPP BAL CAV PR



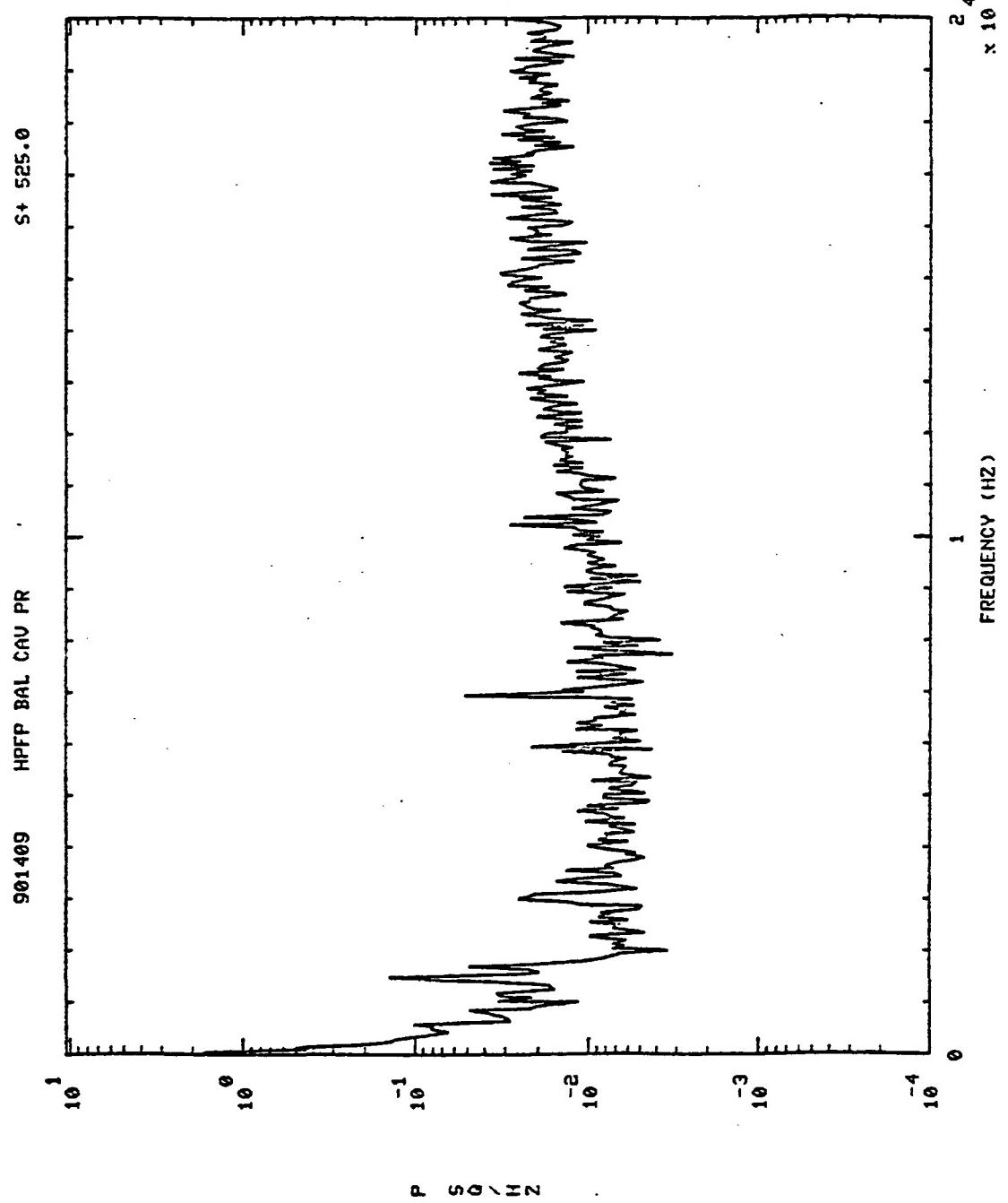


901409 HPFP BAL CAV PR

S+ 500.0

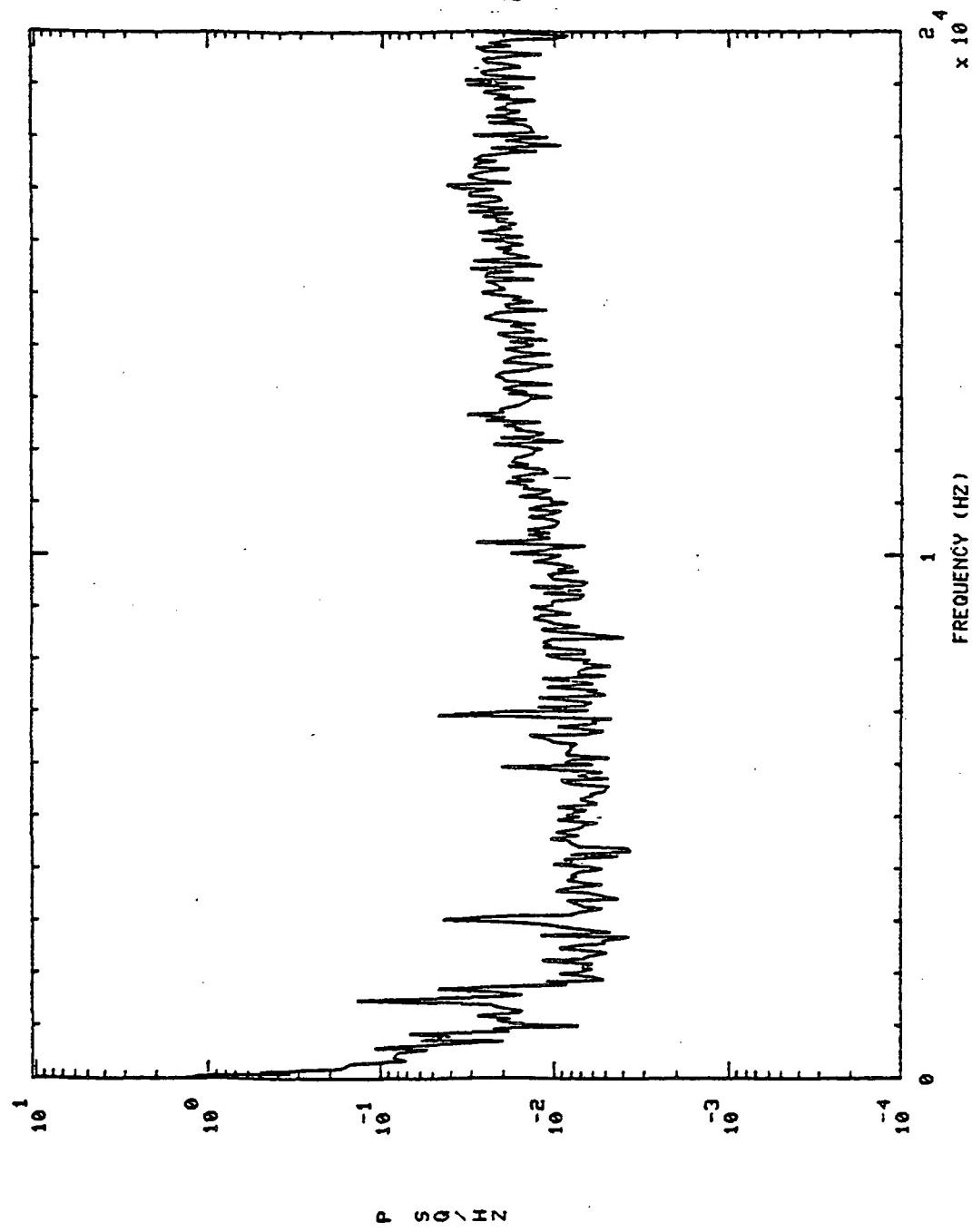


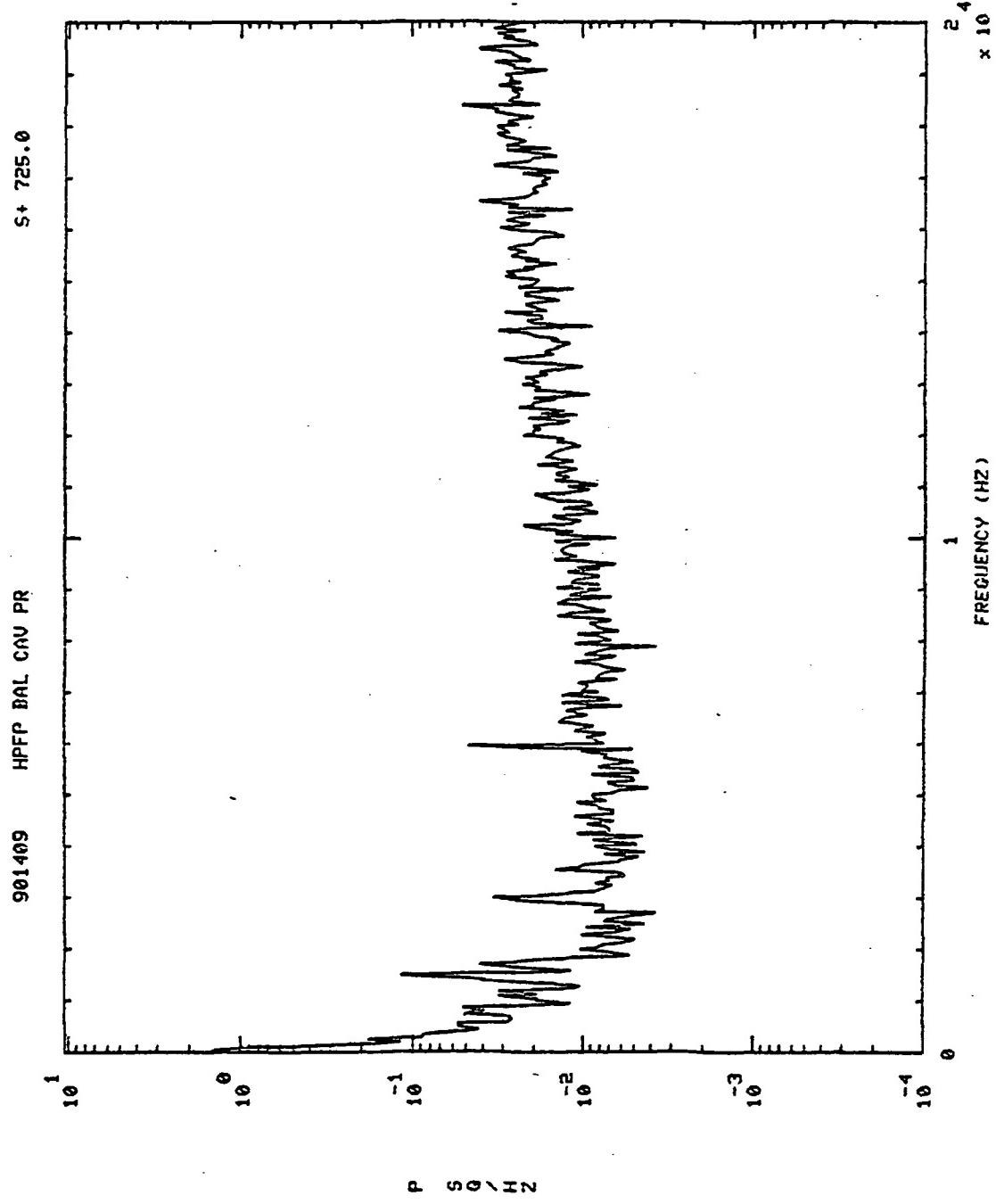
P S Q / HZ



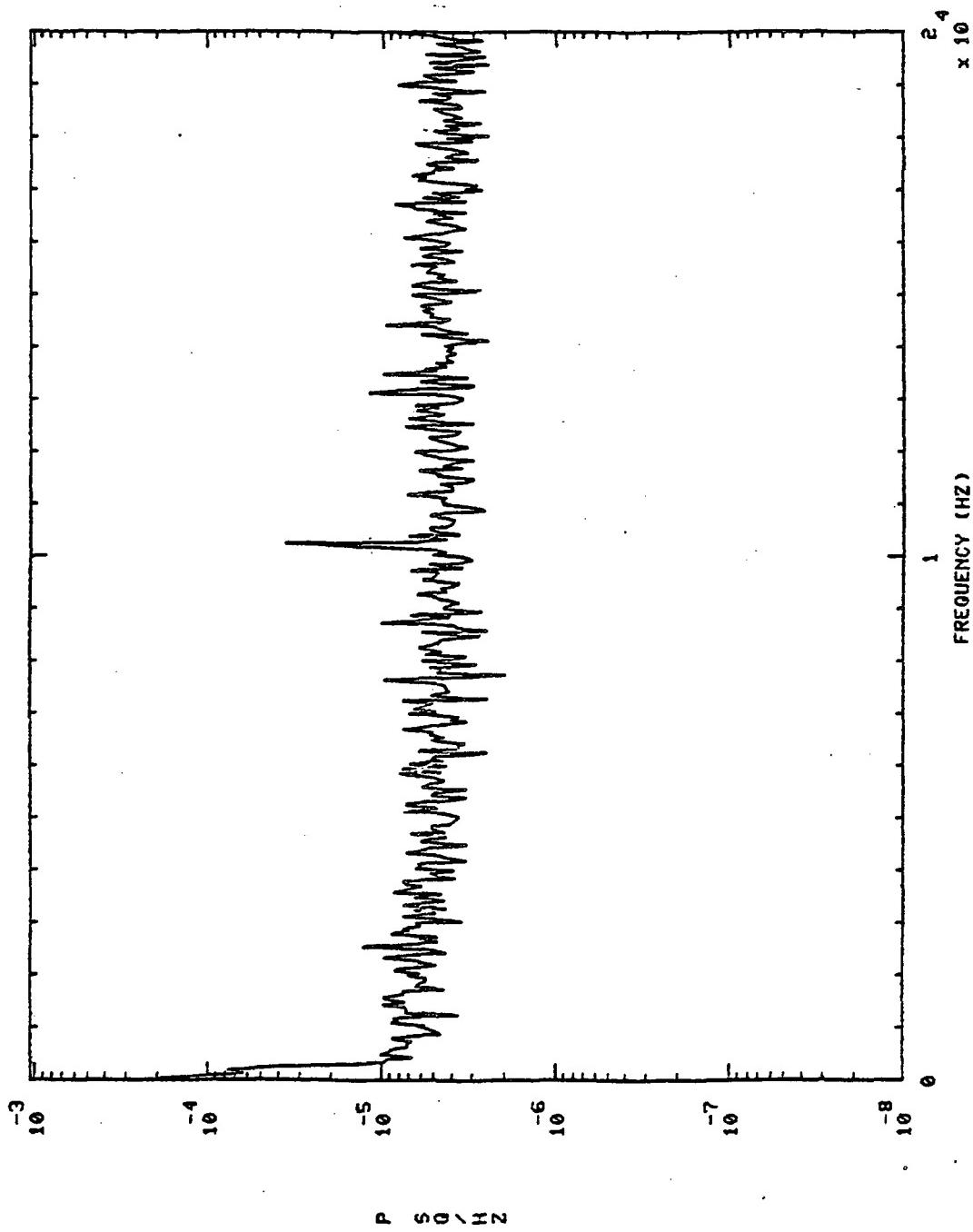
901409 HPFP BAL CAV PR

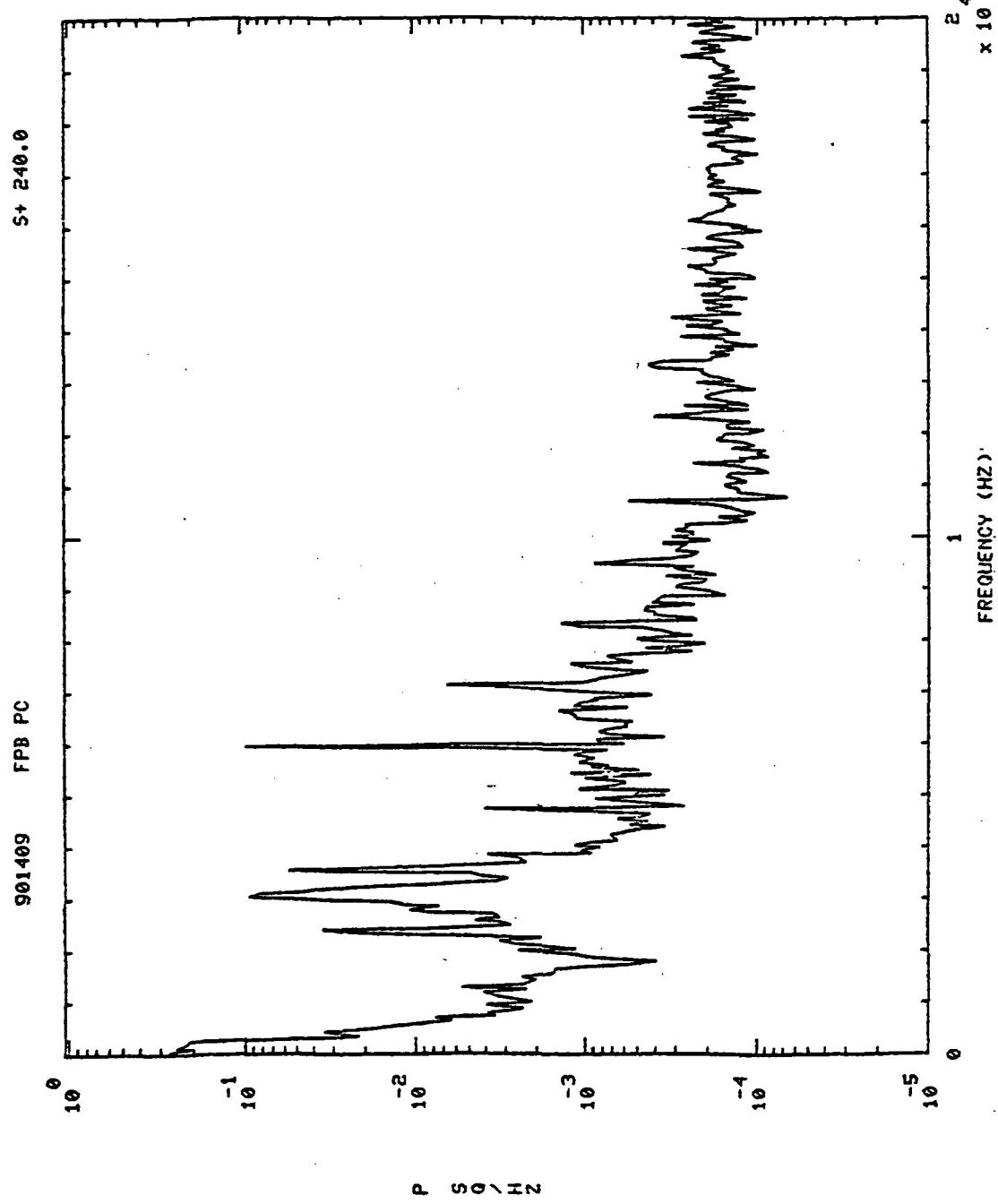
S+ 705.0





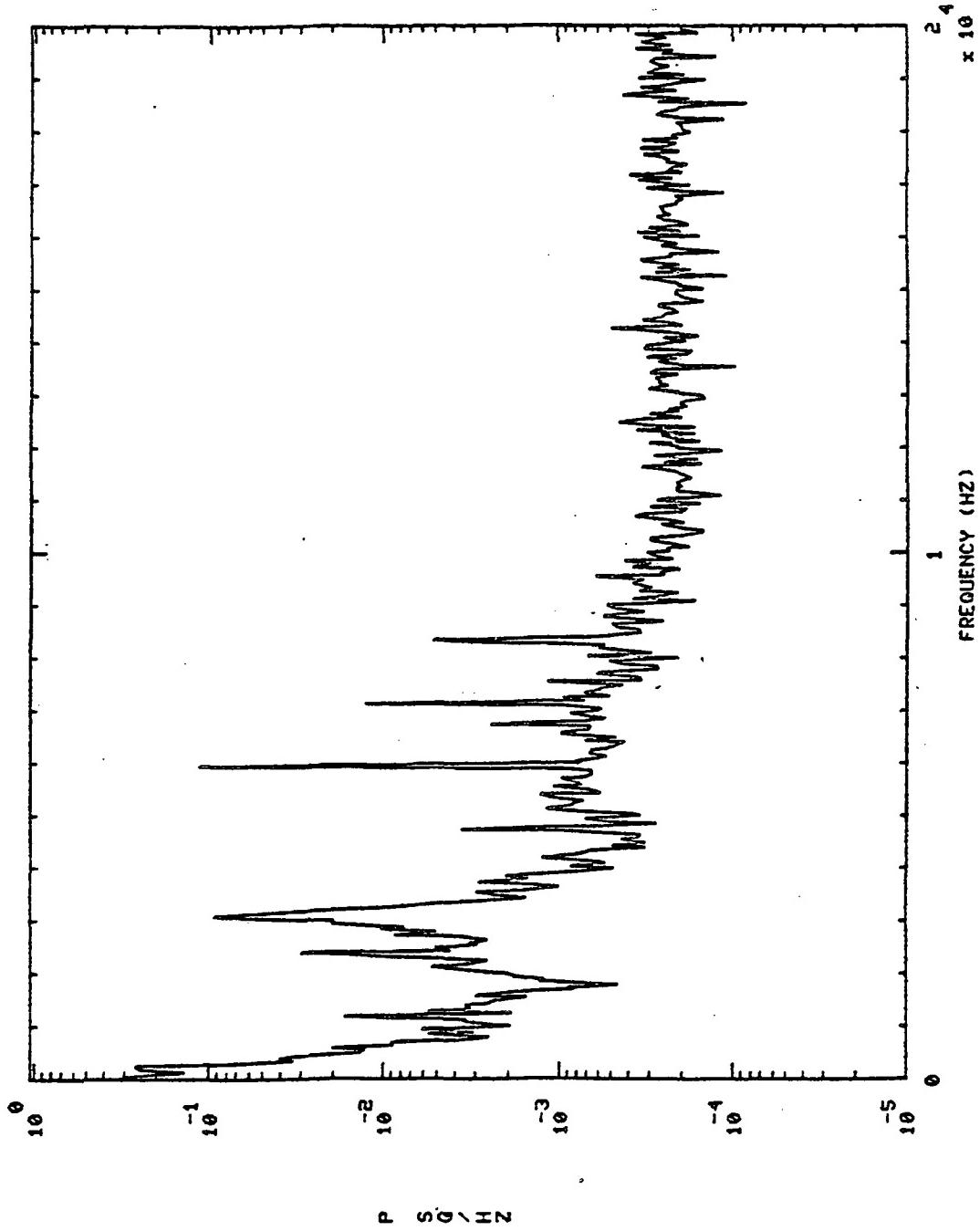
901409 FPB PC

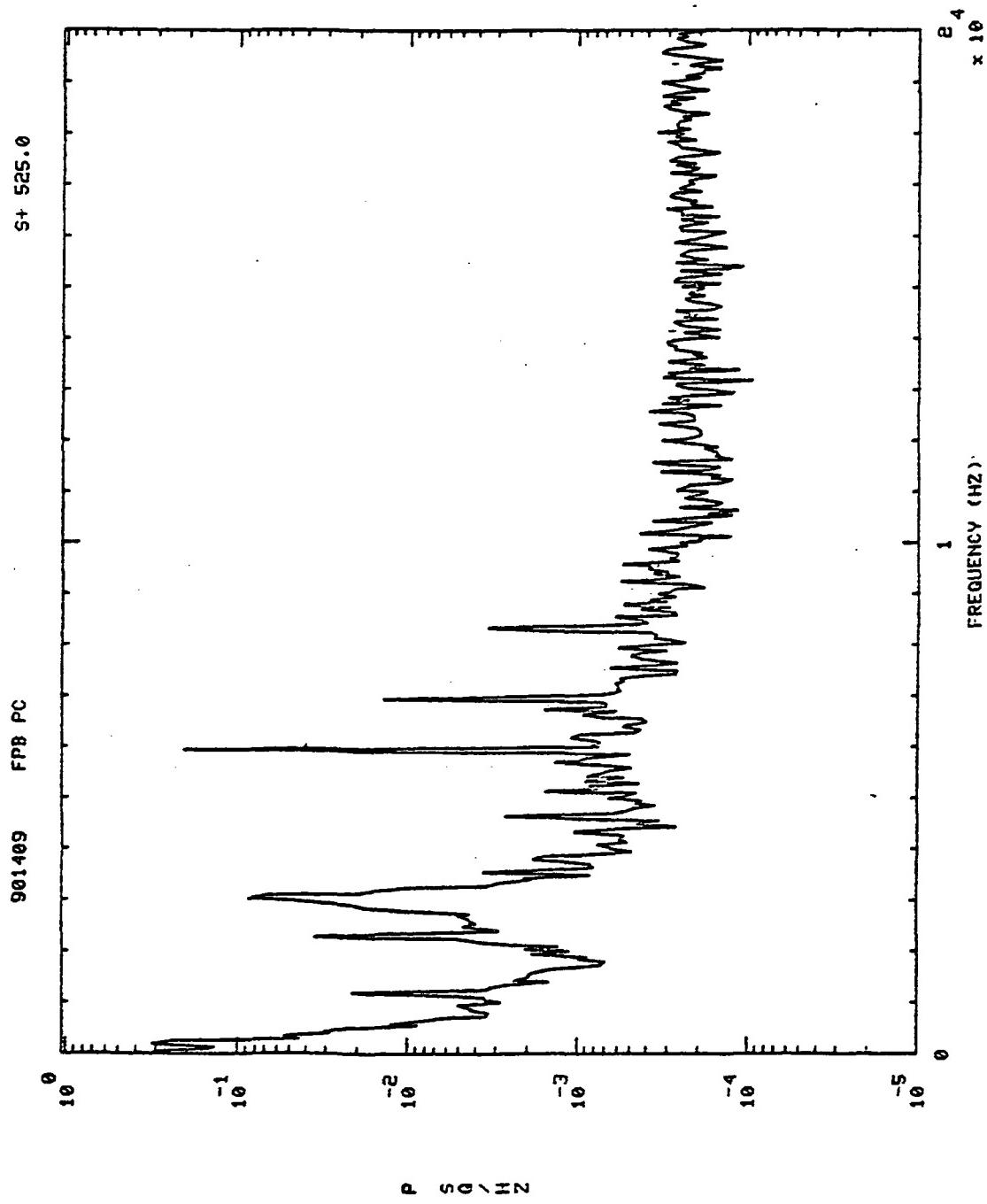




S+ 500.0

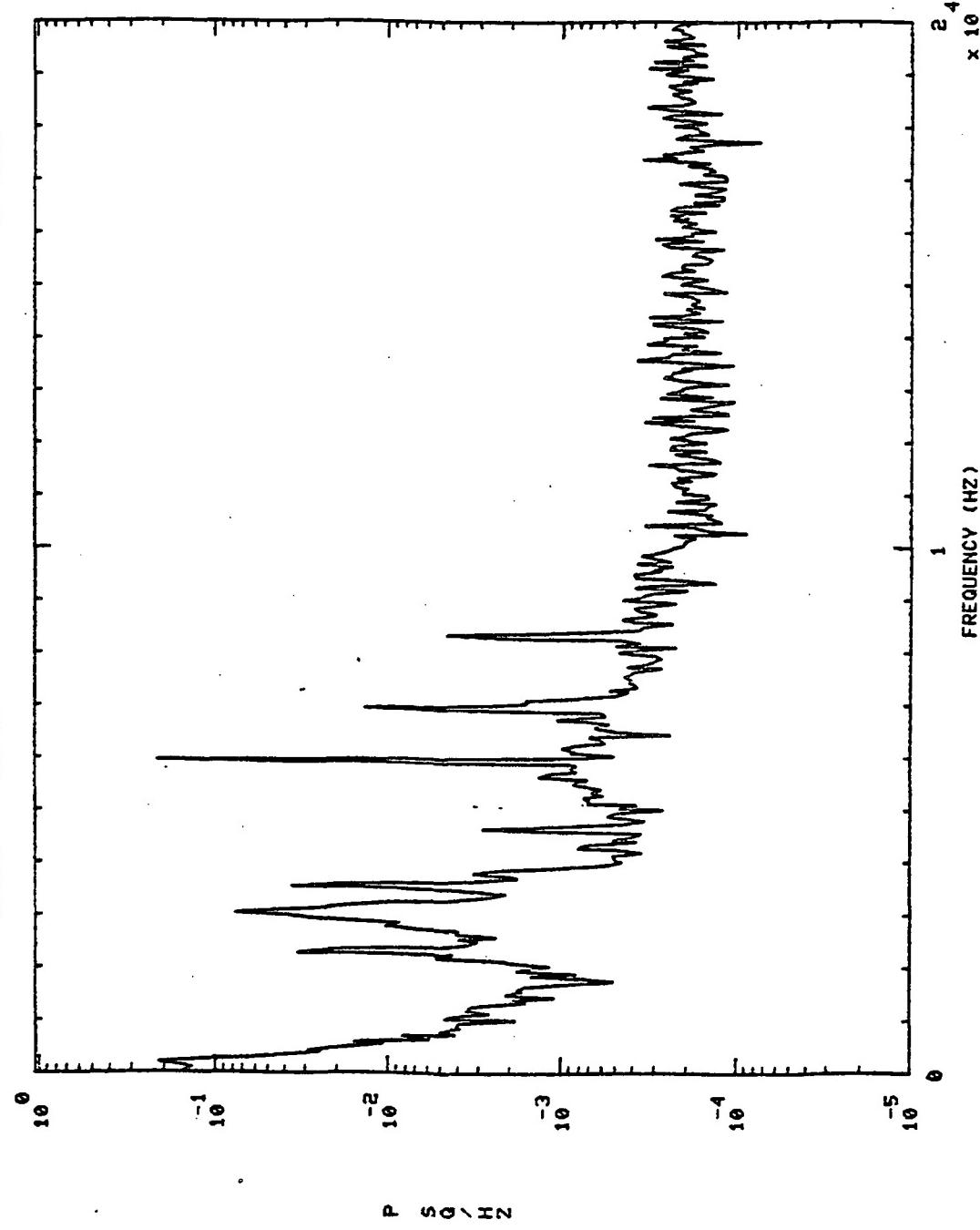
901469 FPB PC

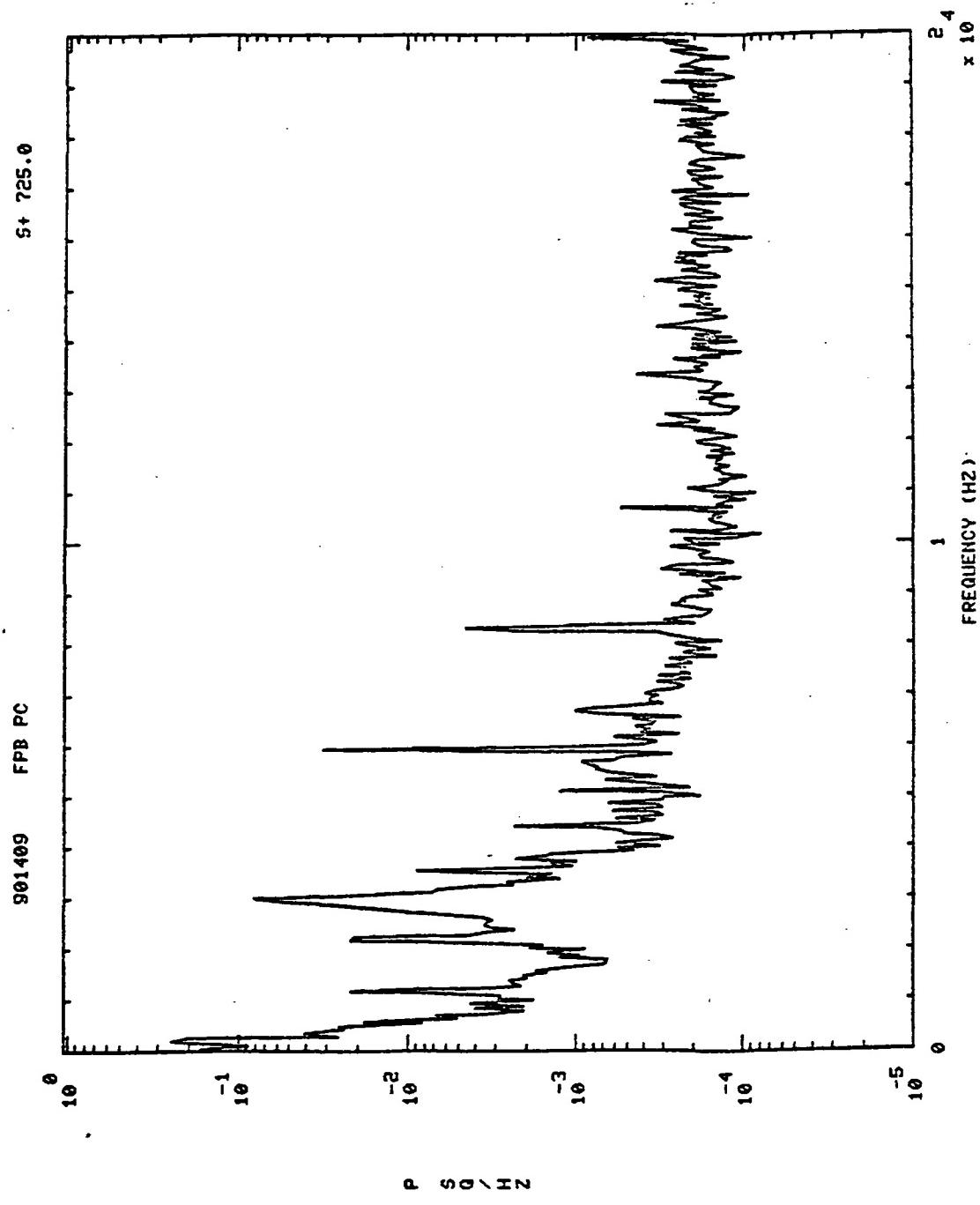




5+ 705.0

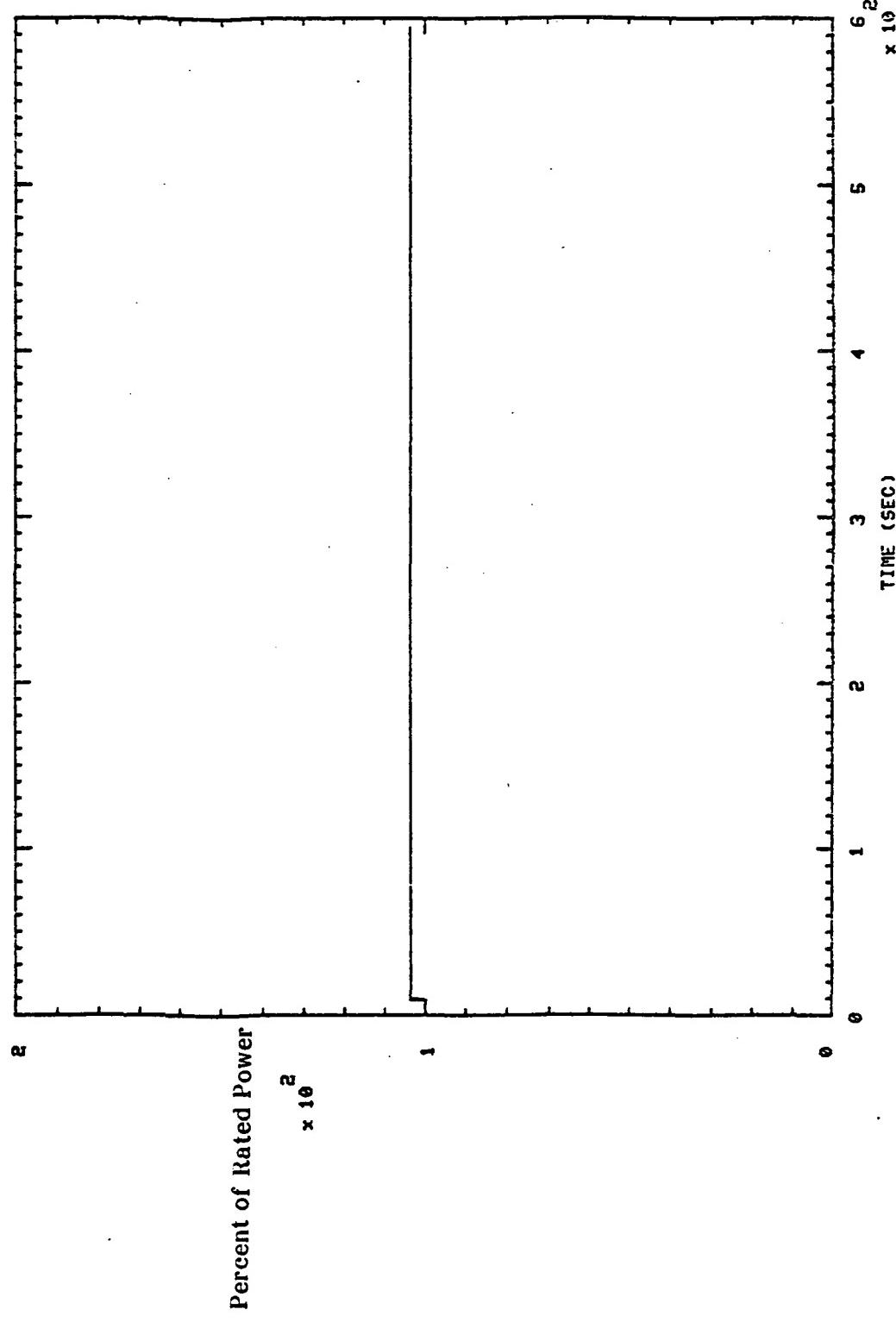
901409 FPB PC

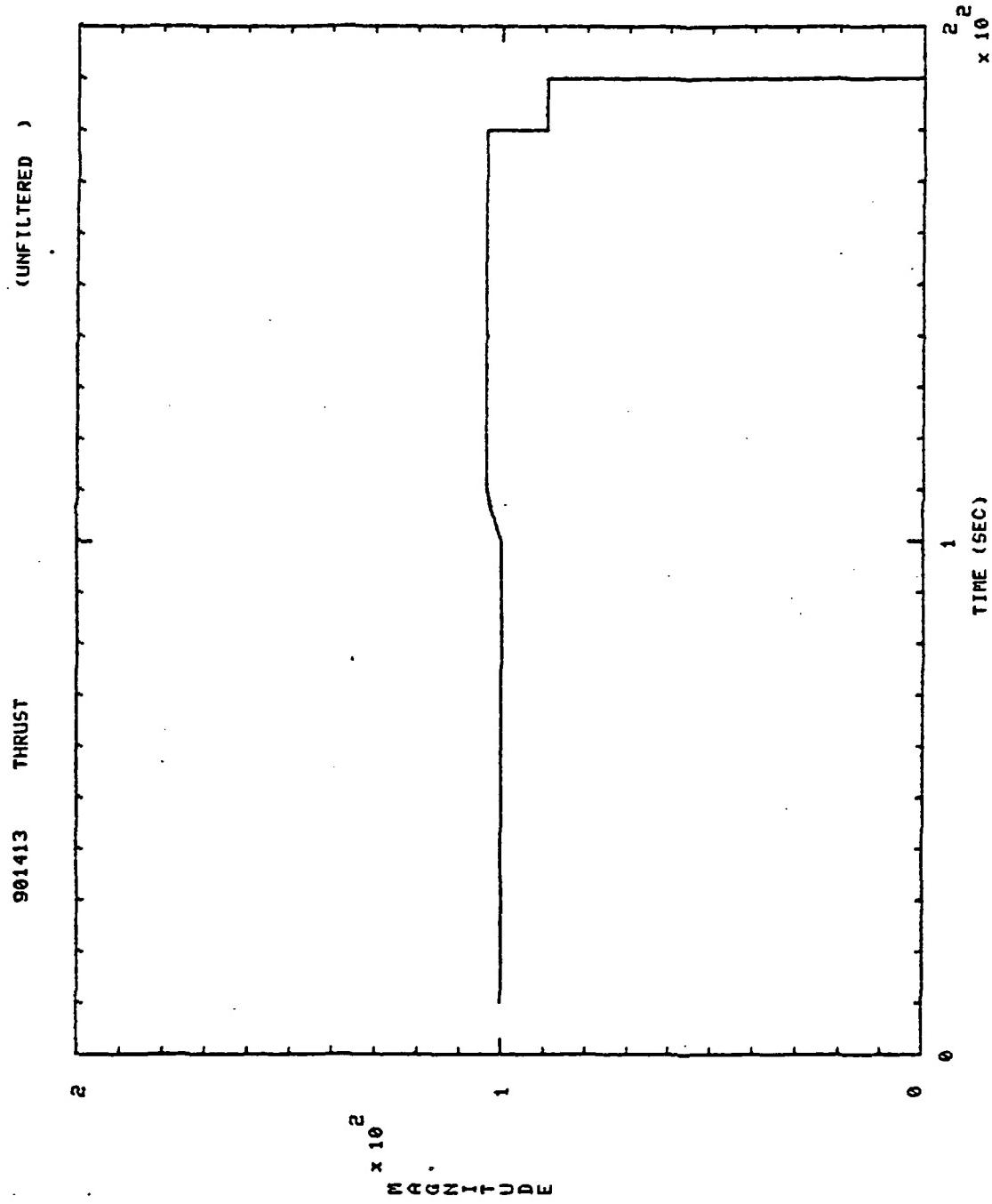




(UNFILTERED)

901410 THRUST





(UNFILTERED)

901414 THRUST

